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FARMERS' BULLETIN
NO. 2187

Managing the **FAMILY FOREST**

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PREFACE

If yours is a one-out-of-every-10 American family which owns a "family forest" (anywhere from a few acres to several thousand acres of timberland, often referred to as a "small forest ownership") then this booklet is directed especially to you.

It outlines how you can grow more and better species of trees, a greater volume of wood in a shorter time, and better quality trees, and how you can market your forest products more profitably. It will not make a professional forester out of you but it will lay before you the opportunities that exist in applying sound forest management practices to your family forest. You should seek the assistance of your local forester for guidance.

America's family forests are owned by people like you: farmers, factory workers, businessmen, professional people, housewives, retired folks, and people in numerous other fields of endeavor not necessarily connected with the timber business. Some owners live near their properties; others are absentee owners. A great dormant economic potential in these family forests has barely been tapped by their owners. These often neglected properties are valuable and deserve the best protection and care. Properly managed, the family forest can be made an important part of the owner's current economic growth; it can add considerable value to his estate and contribute to the natural resource strength of the Nation.

It is well to remember that quality timber is not in surplus and, unlike many perishable products grown on the land, properly managed trees will "keep" until the most opportune market time arrives.

As you study this booklet, ask yourself, "What plans do I have for my woods?" If you're not sure, consult a professional forester at the first opportunity. He can help you make your family forest a full producing part of your land.

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MANAGING THE FAMILY FOREST

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4 million Family Forests

INTRODUCTION

The family forest serves many uses. It provides the habitat for certain species of game and in some localities can provide forage for domestic stock. If properly protected and managed it can prevent erosion on steep slopes, hold back water resulting from snows and heavy rains, and prevent or diminish the damages of floods. The scenic value of forests is well known, and the economic advantages of forests attracting tourists and vacationists are important to many sections of the country. The personal satisfaction gained from the stewardship of forest land is as old as history, and is more important today than ever before. The relaxation afforded by a quiet walk in the forest, the joy of hunting and fishing, or camping or picnicking in the woods has prompted many a businessman or professional man to acquire forest property of his own.

But this publication concerns another multiple use of the forest: the production of timber products for an ever-increasing population. Timber production, under proper management, is compatible with most other uses of the forest. Because of the flexibility in growing and harvesting of timber as a crop, it is often possible to "have your cake and eat it too." Lands managed primarily for recreation, wildlife protection, watershed protection, or other uses can also produce commercial timber. If the timber is properly harvested, this use need not interfere with the other purposes of ownership.

There never was a better time to make the family forest or woodland pay dividends. The care and management it receives now will largely determine the profits it will return in the future. An untended forest, like an untended garden, produces many weeds and few usable products.

Our increasing population—over 2 million more people each year—will require an increasing amount of wood. By the year 2000, it is esti-

mated that we will need to grow 28 billion cubic feet of wood annually—16 billion more than the Nation consumed in 1952. The family forests must supply about one-half of the volume.

Good lumber from large, straight, clear logs will always command a market. Increasing demands for pulpwood and wood for specialty products assure markets for small trees harvested in thinnings. Family forest owners who invest time and effort to put their woodlands in the best condition for continual periodic harvests will get the greatest returns from the expanded markets.

Woodland owners who have good-quality marketable timber are profiting now by following sound management and marketing practices. For example, a north Florida owner had been offered \$1,500 for all the merchantable timber on an 18-acre tract. Not wanting his area to look like some of the logged-off areas in his community, he followed the suggestions of a professional forester. Result: The area was marked for a light improvement cut. Thirty-five thousand board feet of sawtimber and 60 cords of pulpwood were sold to the highest bidder for \$1,625—the unmarked remaining trees of better quality promising another and larger harvest in 5 to 8 years.

This is only one example of hundreds reported annually telling of owners who have profited from good management of small forests. Improved practices are being applied to an increasing number of small ownerships every year.

This booklet is designed to help owners of family forests recognize practices that are desirable and needed on their land, and to help the owners understand some of the reasons for them. Application of the practices will require procedures and techniques that will vary depending on location, site, markets, and other conditions.

WHAT A MANAGED FOREST SHOULD LOOK LIKE



Well-managed forests in any location, be it Oregon or Florida, have certain things in common. The trees are suited to the soil, climate, and locality, and will produce a good salable crop of saw logs, pulpwood, or other products. Poor or surplus trees have been removed to give the good ones room to grow. The well-managed forest has few, if any, overripe trees, trees past their best growing years. It has a minimum of diseased or damaged trees and very few branchy or badly shaped trees.

The forests may be "even-aged," trees approximately the same age and size, or "uneven-aged," trees of several ages and sizes. The species of trees that make up the stand determine the "forest type," and may also dictate whether the stand is even-aged or uneven-aged. Species that demand a large amount of direct sunlight grow best when they start on open areas and all trees are established about the same time. For this reason southern pines are often managed in even-aged stands.

In even-aged stands, the crowns of the trees form a ceiling of foliage, the canopy. The crowns may extend down to $\frac{1}{3}$ or $\frac{1}{2}$ the total height of the trees. The shade caused by a canopy retards the establishment and growth of most young trees and other low vegetation. The forest may or may not have reproduction on the forest floor below the main canopy of trees, depending on the forest type and its stage in the cycle of management.

In uneven-aged stands some trees are mature, some just becoming established, and some at ages between. The beech-birch-maple combination, a northern hardwood type, is an example of stands usually managed on an uneven-aged basis. Several of the species common to this forest type are tolerant of shade, and become established either under large trees or under small openings in the canopy.

The forest floor is covered with needles, leaves, twigs, and small branches. Such a covering permits soil to absorb the large amounts of water that trees need, and it prevents erosion. Usually beneath this litter, a moist, fertile layer of humus covers the soil. On sandy soil, however, the humus may leach away.

The well-managed forest is protected from fire, insects and disease, and even grazing animals. In some parts of the West and South, however, limited grazing by cattle, sheep, and horses does occur on areas growing timber.

Not only is the well-managed forest accessible from the outside, but it also contains a system of permanent woods roads within its boundaries. These roads permit the frequent removal of small quantities of timber products; they facilitate access to the area for cultural operations and are of great benefit in fire protection.



F-476864

Fire and livestock have been kept out of this thrifty, mixed pine-hardwood forest. The forest floor, rich in humus, will hold maximum rainfall and prevent erosion.



PLANNING TO MANAGE THE FOREST

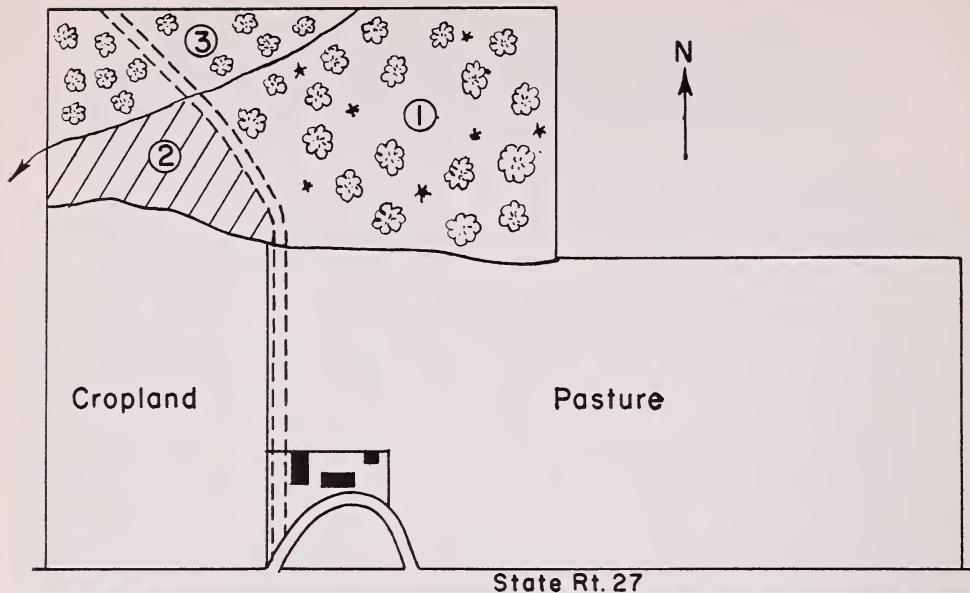
Every forest, whether large or small, should be operated according to a plan based on: (1) the owner's objectives and his financial or physical limitations, (2) the size, condition, and capabilities of the woodland, and (3) expected markets. Depending on (1) and (2), the plan should integrate timber production with practices to benefit wildlife, recreation, forage, water quality, and the appearance of the forest.

For small forests, especially those under about 30 acres, and for woodlands composed entirely of young timber, none of which is approaching maturity for the intended products, a simple plan may be all that is needed. This plan would list the action for a period of time, about 5 years. For example, if reforestation is needed, the plan indicates the area needing planting, number of trees required, species to plant, spacing, approximate date to plant. Planting planned for a specific year or for different years is also indicated. The plan might also show on its map the location of proposed access roads, firebreaks, or other improvements. A release cutting may be planned for a certain area, a thinning for another area.

For a larger forest, where some of the timber is mature or approaching maturity and the owner wants a repeated, frequent income, the plan should include a schedule for harvesting the timber crop on a sustained yield basis. This requires a timber inventory and growth study, on which is based a program of annual or periodic harvest cutting which will assure a continual operation without running out of timber. This more complex plan will include, in addition to the development and rehabilitation work, a cutting budget showing areas to be cut, approximate amounts to be cut, silvicultural systems to be used in harvesting the timber, and data on present volume by species and products, annual or periodic growth, and other information helpful to the forest manager and landowner.

A map is always helpful in showing location of various activities planned.

The landowner should seek the assistance of a forester in preparing the plan, be it simple or complex. Technical assistance is usually available from consulting foresters, industrial foresters, or public foresters employed by most State forestry departments and State extension services. "Service" foresters of State Forestry Departments work closely with Soil Conservation Service farm planners, county agricultural agents, and extension foresters in developing management plans for the forested portion of farms.



FARM MANAGEMENT PLAN WOODLAND SECTION

[approximate scale: 1 inch = 1,000 feet]

| Area No. | Woodland description | Recommended treatment ¹ |
|----------|----------------------------|---|
| 1.. | Pine-hardwood----- | Commercial improvement cut: What to be cut. How to sell it. When it shall be cut again, etc. |
| 2.. | Cut-over----- | Reforestation: Species, spacing and time to plant. Number of trees needed, etc. |
| 3.. | Bottom-land hardwoods----- | Timber stand improvement: What to do. How to do it, etc. |

¹ Forester to prescribe details.

RESTOCKING THE FOREST



Natural Seeding

The cheapest way to reproduce a stand is usually through natural seeding. But this is not always easy.

Ease of getting natural reproduction established varies between localities, forest types, and species. It depends not only on the availability of seed, but also upon available moisture, favorable summer temperature, condition of the seedbed, number of rodents, insects and

diseases, and amount of grazing by domestic and wild animals. In areas where it is difficult to establish natural reproduction, as in sections of the West where the summers lack rainfall and soil is apt to become very dry, technical advice should be followed to improve chances of a satisfactory restocking with desirable species.

Most uneven-aged forests, unless badly damaged by fire or grazing, reseed themselves. The kind of trees found in the reproduction following a harvest cut can often be influenced by timing the cut to coincide with a good seed crop of the desirable species and by cutting less desirable species more heavily.

In fully stocked, even-aged stands with a dense canopy, few seedlings will develop into trees because of lack of sunlight. Natural reproduction becomes established when the mineral soil is exposed, sunlight reaches the forest floor, and seed is available.

Natural seeding is influenced by the timber harvest operation and details on this are found in the section "Planning a Harvest Cutting."



F-465440

Natural white pine and spruce reproduction under a stand from which a harvest was made 15 years earlier.

Artificial Seeding

If no seed source is present, or if the seed source fails to do the job within a satisfactory time, the area will have to be reforested by other means. This can be done in some instances by seeding, sowing seeds collected from another source.

For many years efforts to establish trees by seeding resulted in only spotty success. Recently, chemicals that repel birds and rodents have been developed and these are applied to the seed as a coating. The local technician can furnish information on sources of chemicals or treated seeds.

Seeding can be done in a number of ways. Seed can be broadcast from the ground by hand or with a cyclone seeder. It can be sown in spots by hand or with a hand-operated seeding tool. Tractor-drawn row seeders of various types are available. For large areas seed may be broadcast from aircraft.

The advice of a forester should be sought to determine the seedbed preparation required, the type of seeding equipment to use, the best species, the proper rate and time of seeding, and how to treat the seed. Research is continually discovering improved chemicals and techniques for seeding. Be sure you have the latest information available for your area. If seeding is practical on the site to be reforested, it is usually cheaper, easier, and quicker than planting trees. Seeding requires close attention to details or costly failures may result.

Planting Trees

The first forest trees planted in this country were wild seedlings dug in the forest and replanted on an unstocked area. Later, seedlings were brought from Europe and planted in parts of New England and the southern Appalachians. Today, seedlings are grown by the millions in public and private nurseries. There is a wide variety of species and sizes from which to choose. State nurseries in nearly all States grow forest tree seedlings for planting on private land. These seedlings are available upon application, usually with restrictions as to their use, for prices from no charge to approximate cost of production. The local forester, county agricultural agent, or local Soil Conservation District Office can assist landowners in making application.

When to plant.—Time to plant trees varies greatly from place to place and with the character of the soil and local climate. In southern areas planting is done throughout the winter when weather permits and the ground is not frozen. In northern areas planting is done mostly in the spring. If the soil is light, or there is no danger of frost heaving, and there is abundant moisture, fall planting in northern areas after growth has stopped produces good results with some species. If danger of frost heaving exists or if soil moisture is deficient in the fall, planting in early spring is preferable. Planting should always be done before new growth starts in the spring.

Where to plant.—Trees for timber production should normally be planted only on land that is better suited for growing trees than for growing any other crop. Trees planted on the better agricultural lands usually produce less income for the owner than do other agricultural crops, but trees may be a profitable substitute when planted on lands withdrawn from cultivation. Land classed as nonagricultural because of steepness, inaccessibility, or type of soil will often produce timber and at the same time conserve soil and water. The

most expensive areas to replant are those occupied by undesirable plant species, brush, or worthless trees.

Many landowners do not wait for natural reproduction after harvesting mature timber, but plant trees on the area immediately following the cut. This is a common practice in certain forest types and on sites where worthless species of vegetation appear promptly following the harvest. The trees established by prompt planting are better able to compete with the undesirable vegetation than trees resulting from natural seed fall. Planted trees will have one or two years' start on the brush. In some areas the possibility of insect damage to seedlings after logging makes it advisable to delay planting for a period of several months.

What species to plant.—It is usually safe to plant the species that are native to the area, but this may not always meet the owner's requirements. Growing conifers where hardwoods are native may sometimes be better. Most State and extension foresters have prepared guides for selecting the species of trees that will grow on different sites. To assure the best choice of species and to make sure the species will grow well on a particular site, consult a local forester.

Generally, conifers will grow well where hardwoods may not: In worn-out fields and pastures; in sandy, burned-over, or eroded areas; or in shallow, heavy, or cloddy soils. Hardwoods grow well in deep, rather loose, crumbly soil with plenty of room for root development. Most trees, especially the higher valued hardwoods of the East, need considerable moisture in well-drained soil.

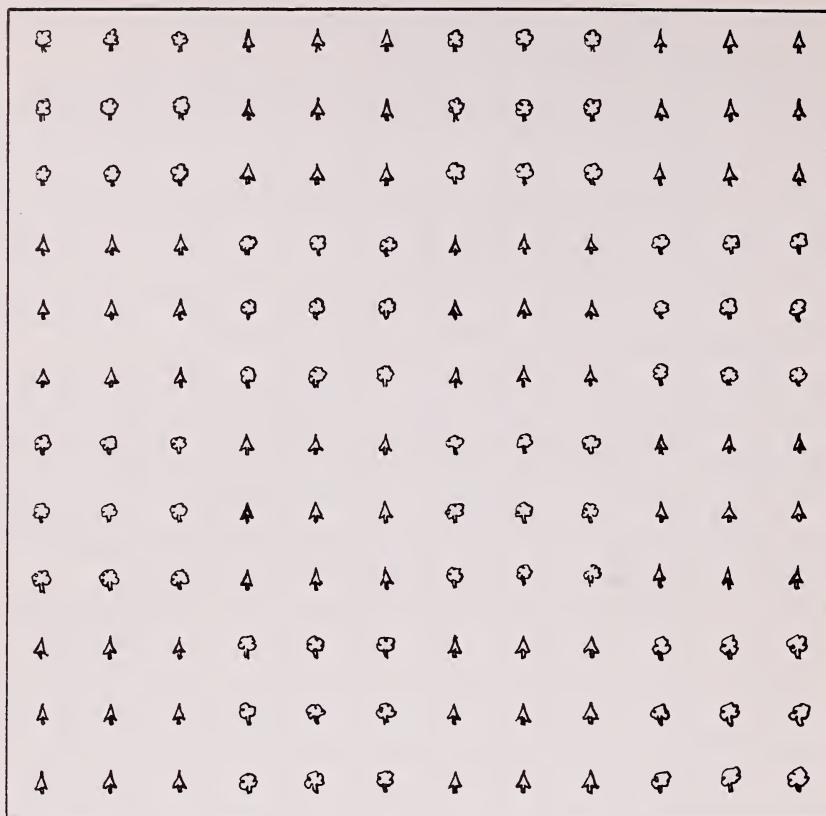
Spacing of seedlings.—Spacing of seedlings varies with species, site, market demands, and climate. If Christmas trees are to be harvested, a spacing as close as 5 x 5 feet can be used. Where the aim is to grow sawtimber in a relatively short time, in the absence of a market for small products, spacing as wide as 12 x 12 feet can be used for fast growing pines or high value hardwoods under intensive culture. The usual spacing is 8 x 8 feet with a trend toward a rectangular spacing growing the same number of trees per acre but permitting access by mechanical thinning equipment. The general aim is to have 500 or 600 trees per acre when the plantation is well established.

| <i>Spacing (feet):</i> | <i>Trees per acre number</i> |
|------------------------|----------------------------------|
| 5 x 5 | 1,742 |
| 8 x 8 | 680 |
| 10 x 10 | 435 |
| 12 x 12 | 302 |

Mixtures.—Planting two or more kinds of trees together in blocks or strips often has distinct advantages. If one kind is badly damaged by insects or disease, the other kind may still grow into a good timber crop. Furthermore, when trees growing in mixture are attacked, damage is likely to be less severe than that in pure stands.

In block planting two or more species of trees, each species is planted in squares of about 9, 16, or 25 trees. Putting in several rows first of one kind of tree and then of another is called strip planting. Alternating single rows of trees is generally not recommended.

Types of planting stock.—Planting stock is designated by two digits separated by a hyphen, the first digit indicating the number of grow-

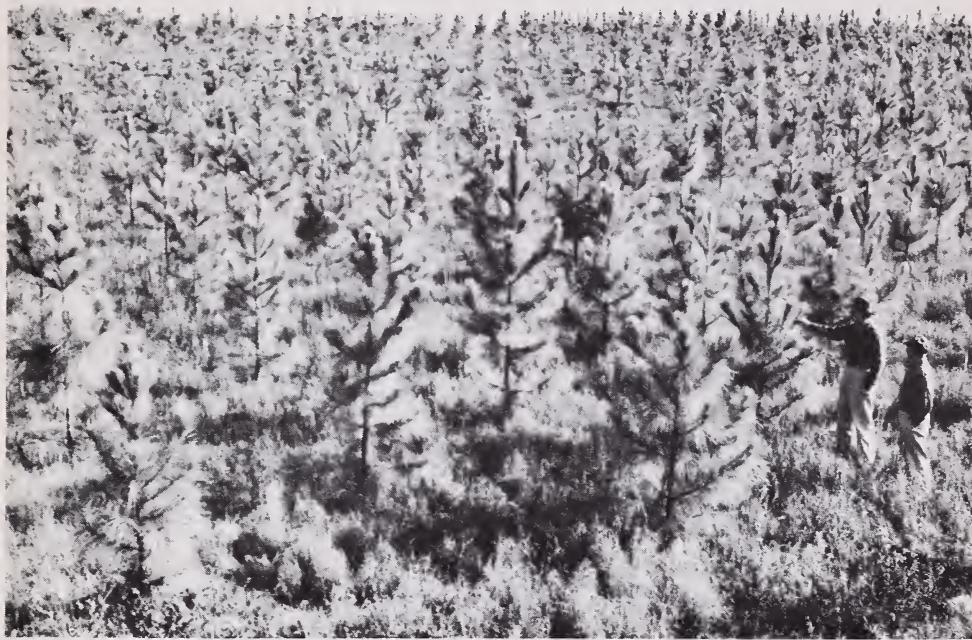


Block planting is one way of mixing two species.

ing seasons the stock was in the seedbed and the second digit indicating the number of seasons the stock was in the transplant bed. Planting stock listed as "2-1" is stock that has been in the seedbed two growing seasons and moved to the transplant bed for one season. In some sections of the country, a planter has the choice of using seedlings or transplants of various ages. In the South, seedlings of certain species grow so rapidly that 1-0 stock is used exclusively. In other sections stock grows so slowly that 3 or 4 years are required to produce trees of plantable size. In such areas transplants of the slower growing species are frequently more hardy and have better root systems than seedlings. Good planting stock has a good balance between roots and top.

State forest tree nurseries usually produce stock best suited for planting in their respective States. The age of planting stock is not as important as its physical characteristics and condition at time of planting.

Care of planting stock.—The proper care of planting stock from the time it leaves the nursery to the time it is planted cannot be overemphasized. It must always be protected. The roots of many species are extremely delicate and if exposed to sunlight or to hot drying winds for only minutes the trees will not grow when planted. Nor should tree roots be exposed to freezing temperatures.



F-501913

A thrifty 5-year-old pine plantation in the lower Piedmont.

Most nurseries cull the stock to eliminate substandard trees, and ship the stock in bundles or boxes well packed with moisture-retaining material. Preparation for shipping varies by kind of stock, locality, temperature, and season of the year.

Trees should be shipped via a fast carrier. Railway express shipment will be satisfactory provided advance arrangements are made to remove stock from the express office shortly after it arrives.

Transportation by covered trucks is most desirable; and the driver should be instructed to properly protect the stock from adverse exposure. When transportation is by open trucks or trailers the bundles of stock should be completely covered with a tarpaulin.

Ordinarily no watering is needed in transit if the shipment has been properly prepared and if the period of transit is less than 24 hours. Bundles of trees should never be thrown in a water tank to soak.

As soon as trees are received they should be inspected and their condition determined. Instructions for their care, provided by the nursery and usually attached to the shipping container, should be followed.

Trees should be planted as soon as possible after delivery from the nursery. If they will not be planted for several days, the local forester should be so notified and his suggestions followed for special handling of the stock.

How to plant trees.—If the planting site is not too steep and is relatively free from obstacles, a planting machine may be used to advantage. These machines vary in type and capacity, and are designed to meet various conditions. They may be rented from many

State forestry organizations, Soil Conservation Districts, Chambers of Commerce, and banks.

In most cases the landowner must supply the motive power, usually a farm tractor. He should make sure that he has the right size and design of planter to plant the trees at the required depth. The tractor should be large enough to pull the planter at this depth. The planter should also be equipped with properly designed and functioning scalpers if removal of the sod is desirable.

Private planting contractors who own planting machines are available in many sections of the country. A written contract should be used to avoid misunderstandings. Where possible the owner should supervise the planting so that if a good job is not being done the work can be stopped and the necessary adjustments made before planting is continued. (See page 60 for items to be included in a Tree Planting Contract.)

In areas where the mechanical planter cannot operate, the planting bar and the planting hoe continue to be the most effective handtools for tree planting. Shovels, spades, and mattocks also are used effectively.

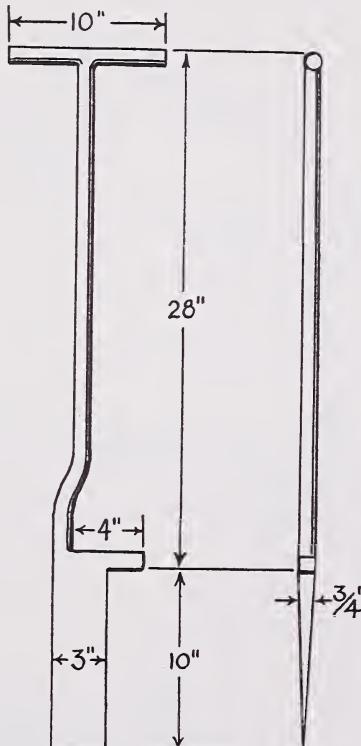


F-488764

A modern tree planter.

The bar is fast and satisfactory for "slit" method planting in light soils with few rocks. It does not work well in heavy soils, or in areas where scalping the sod is desirable before planting the tree.

The local forestry or agricultural agent will have publications on the recommended procedures for planting trees in your State. Be sure to study these before starting your planting job.

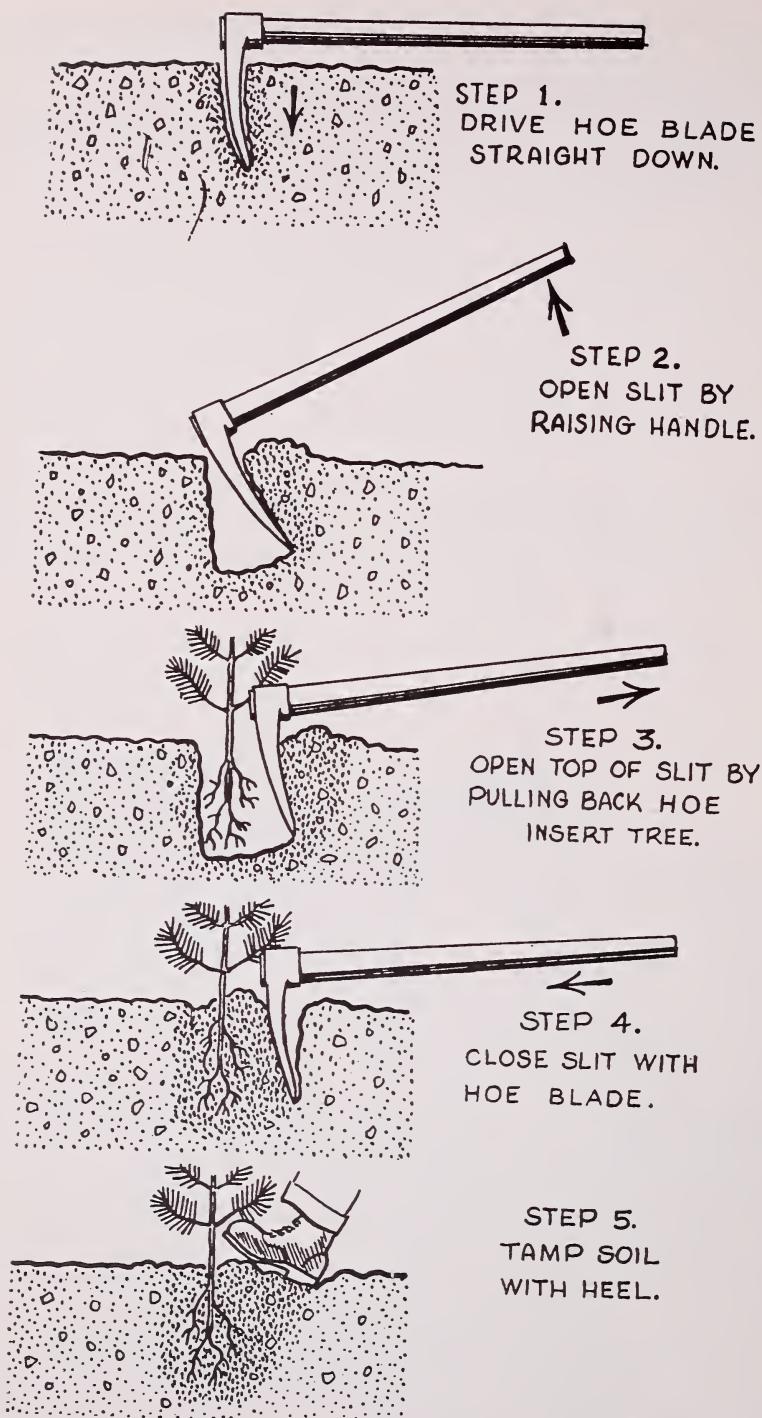


Planting bar.

The basic principles of tree planting apply to all methods of planting—whether with a mechanical tree planter, or with the planting bar, planting hoe, or shovel. Violation of any one of the following principles can result in failure of the plantation:

1. Where soil moisture is a factor, eliminate competing vegetation (roots and all).
2. Keep roots of trees moist at all times, protected from the hot sun and dry air.
3. Make a hole deep enough for the roots to assume their natural position.
4. Place tree in the hole as near its natural position as possible—roots extending downward and tree at proper depth in the soil.
5. Pack soil firmly around roots so no air spaces adjoin the roots.

Preparing the planting site (principle 1) can be done in many ways, depending on conditions. Undesirable vegetation (hardwood or brush) is frequently removed effectively by prescribed burning, girdling, applying chemicals in girdles or frills or as basal spray or



Planting a seedling with a planting hoe.

foliage spray from air or ground, or bulldozing with special blades, disk plows and harrows, or brush cutters.

Where soil moisture is a critical factor, even sod must be removed before planted trees will live. In sections where summer rainfall is plentiful, however, the sod may not interfere. Methods of site preparation will vary according to conditions encountered and equipment available. Preparation may consist of removing sod by scalping it from an area 15 by 15 inches with the planting hoe or from a strip each side of the planting slit with scalpers attached to the planting machine, or it may involve removing brush with a bulldozer. The local forester can advise the landowner of the most economical and effective method for the particular planting site.

Preparing the hole (principle 3) can be done by any of several methods. A slit or temporary hole can be made with a mechanical planter, planting bar, planting hoe, shovel, or any other suitable tool. Holes dug with a mattock or shovel before planting should not be left open because this will permit the soil to dry out. Plant the trees immediately after the holes are prepared. The holes or the slits must be deep enough for the roots of the trees to be placed in their natural position.

Placing the tree in the hole properly is also extremely important. Although the tree may live for several years even if the roots are not properly placed, experience has shown that very often the roots will not grow down, but continue to grow along the surface of the soil.



F-493549

Bulldozer being used to prepare planting site by removing undesirable brush.

Because of this the tree is made vulnerable to windthrow when it gets enough height for the wind to exert leverage action on it.

Eliminating air pockets around the roots of the planted tree (principle 5) assures that the roots will not dry out as long as there is moisture in the soil. This is done by compacting the soil well around the roots, at the same time being careful not to damage either the roots or the top of the tree. Material such as leaves, wood, and rocks should not be put in the hole; mineral soil is the desired material to contact the roots.

Need for plantation care.—Many aspects of plantation care are similar to those required by natural stands of trees. Plantations, however, require additional care. Very often the species is selected not because it is ideally suited for the site but because it fulfills the owner's requirements. Plantations are more vulnerable to insect and disease attack than are natural stands and the loss of trees is more critical. They should be inspected frequently for evidence of insects or disease attack and rodent, grazing, and other damage.

Natural seeding frequently provides several thousand seedlings per acre, of which fewer than a thousand are needed to produce a desirable stand. Some mortality of seedlings in natural stands is therefore expected and sometimes desirable. This is not so in plantations where a minimum number of trees are planted.

HELPING THE FOREST TO GROW



Many people assume that once a forest is started it will grow by itself. This is true to a certain extent, just as a garden, after being sown, will grow. Both will grow faster and produce more crops if the operator or gardener protects them from pests, removes the weeds, thins out the plants that are too dense, and harvests the crops properly.

Only rarely will the untended garden produce a bumper crop. The same is true of the untended woodland. Most people do not realize the potential of a woodland because in the past so few of them were properly managed, while the results of a well-tended garden are apparent in a few months. It takes years to derive the full benefits of good forest management if the owner must start by planting the trees. And it takes even longer if he starts with a worn-out woodland, the result of mismanagement in the past. The worthless or undesirable, low-value, residual trees must be eliminated before the woodland can be restocked with desirable species.

Simply stated, good forest practices consist in keeping all the woodland area producing the maximum high-value products all the time. To do this the stand of trees must be fully stocked but not so dense as

to cause overcrowding and not so sparsely stocked that some areas are producing nothing of value.

Most woodlands already contain the potential for future productivity. Young seedlings or saplings of valuable species often are present but suppressed by larger inferior or valueless trees. Seed trees may be present but chance of natural restocking is poor because of a heavy ground cover of weed species. Even pole-sized trees of valuable species often are being suppressed or deformed by overtopping cull trees left from earlier logging operations.

Timber Stand Improvement or TSI is the term used to identify all cuttings that are not a part of the major harvest operation but which are made for the purpose of improving the composition, condition, or rate of growth of the stand. There are many different types of operations involved in TSI work, but frequently they are carried out simultaneously as one operation. For ease of explanation, they are described separately here.

Weeding

As the gardener pulls the weeds from among the vegetables, so the woodland manager, early in the life of the forest, eliminates the weed species of trees. When this operation is done early—when trees are still only saplings, less than 4 inches in diameter at breast height—it is termed a "weeding" or a "cleaning." Rarely is there a market for the weed trees removed, for they are too small. Usually they are cut off at any convenient height and left where they fall. This operation, just as necessary as weeding the garden, is an investment in the forest.

Thinning

Young even-aged stands or groups of trees frequently need thinning when 15 to 30 years old. Whenever the crowns are crowded or are less than one-third the total height of the tree, the forest should be thinned. Enough trees should be cut so that each crown has room to grow on at least two sides without being crowded for a period of 5 to 10 years.

Thinnings should be made frequently enough to reduce competition for light and moisture and thereby maintain vigorous growth. The proper stocking for best growth varies greatly in different forest types, sites, and geographical areas. Generally about one-quarter to one-third of the wood volume is removed in a thinning. Fast-growing trees can be thinned more than slower growers. Consequently, rules-of-thumb—of which there are many—are poor standards for good forest management. A clump of 8 or 10 good trees with room on the outside but crowded in the center might be thinned to 2 or 3 according to a rule. Wise selection, however, and cutting of perhaps three might give a larger proportion of the group enough room. Likewise, a thrifty young tree should not be cut even if it is growing directly under an older tree that will soon be harvested. In short, each tree should be sized up separately for its chances of growing into a profitable individual. Because of the technical problems involved in a thinning, a forester's advice should be followed.



F-277238

A weeding cut has been made in this young hardwood stand.

Liberation Cutting

The removal of trees which overtop seedlings or saplings is often referred to as a "liberation" or "release" cutting. If the overtopping trees are marketable, they of course can be removed by a commercial sale. But very often there is no market for such trees because of the species, poor form, or the presence of decay. They should then be killed or disposed of in the cheapest way without endangering the desirable trees in the stand. On the basis of species, danger from insects and fire, and other local conditions, the forester can advise the owner which of several methods of disposal is best—girdling, felling, or poisoning.



F-451247

This young stand of longleaf pine needs thinning. Trees are being selected and marked for removal.



F-451355

A 16-year-old loblolly pine stand thinned by removing 7 cords of pulpwood per acre.



F-486400

Liberating pines growing under inferior trees.

Improvement Cutting

Many unmanaged forests are greatly in need of an "improvement" cutting. This is a cutting made in a stand past the sapling stage (more than 4 inches in diameter breast high) for the purpose of improving its composition and character by removing trees of less desirable species, form, and condition in the crown canopy.

An improvement cutting is usually done by a commercial sale or a home use operation. If no markets or uses exist for trees that should be removed, and there is little prospect for such in the foreseeable future, the forester may recommend that they be killed. Even if a commercial sale is possible, usually some trees are not marketable or suitable for home use. When trees of poor quality are so numerous that their removal would open up the stand too much, it is sometimes best that cutting be done in two or three operations with a suitable interval of time between.

Pruning Crop Trees

Ordinarily, pruning is limited to those selected trees which will be harvested for saw logs, veneer, or other products requiring logs of large size and high quality. Such trees are commonly referred to as crop trees. They are more valuable if a large portion of their volume is free from defects, including knots. Knots are the result of limbs or branches extending from the trunk of the tree. If these branches are removed from the lower part of the trunk at an early age, when

the trunk is small in diameter, the wood will grow over the wound and produce clear-grained wood outside of the core.

Not all trees respond favorably to pruning: Some species will sprout again where a live limb was cut off.

Only fast-growing trees should be pruned. On slow-growing trees the pruning takes so long to pay off that the returns are comparatively small. A dense stand of timber should first be thinned to insure rapid growth—then pruned.

The number of crop trees to be pruned per acre varies by species, site, and size of the product. Keep in mind that the only trees that need to be pruned are those that are to be retained as final sawtimber or veneer crop trees, usually less than 100 to the acre.

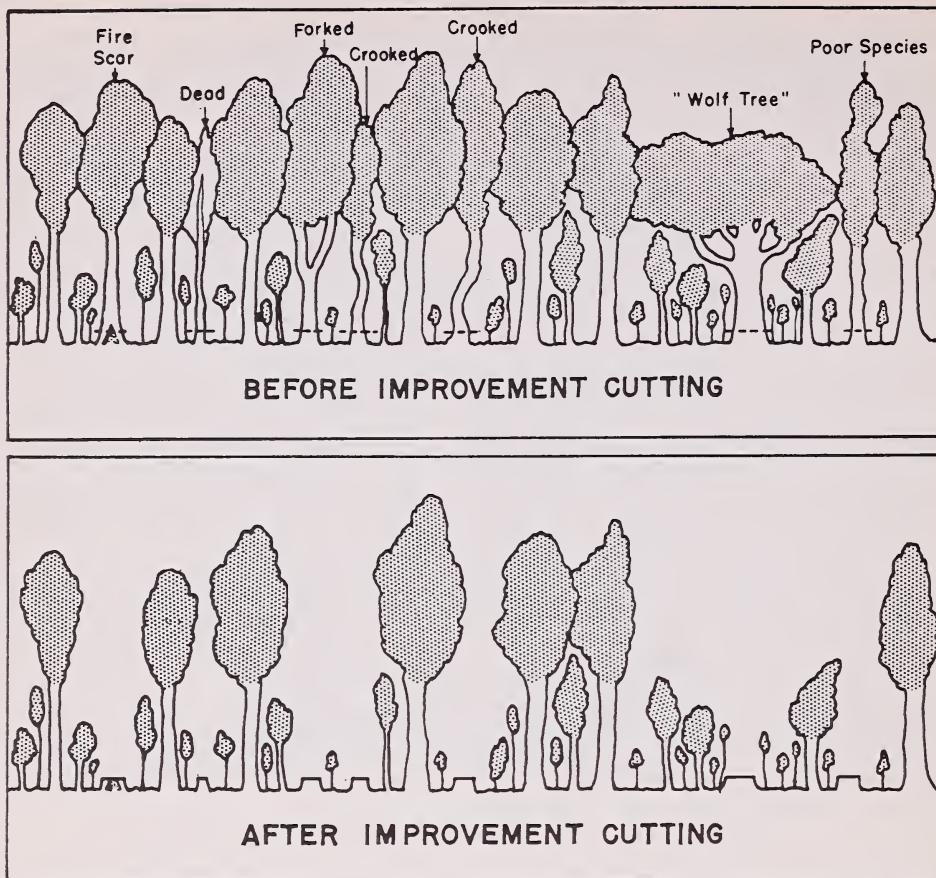
The tree should be 3 to 10 inches in diameter at the first pruning. At this age cuts heal rapidly. The cuts should be very close to the trunk—in fact it does not hurt to scratch the bark of the main stem in order to get a close cut. Stubs should never be left extending from the trunk. Generally, up to one-third of the live crown may be pruned at one time, provided that at least one-third of the total height of the tree remains in live crown. Pruning in two operations, several years apart, may be desirable in order to get at least one clear 16-foot log.

Pruning should be done preferably in the fall or winter, usually with a saw or pruning shears—never with an ax. Special pruning saws are available; these may be attached to long handles to reach 17 or 18 feet, thus providing for a 16-foot pruned log above stump height. Ladders are sometimes used.



F-47099

Undesirable trees occupy much of the space in this woodlot.



F-417054

What to take out to improve the forest.

Control of Undesirable Trees

The unmanaged forest usually contains some unmarketable trees that should be removed. This can be done either mechanically or with chemicals or by a combination of both methods. Control techniques, materials, and equipment are developing rapidly. Methods of control in use this year may be replaced by more efficient ones next year. Mechanical methods range from the simple use of an ax to motor-driven girdling tools. Several chemicals are used to kill trees. These may be applied simply by pouring the solutions into frills or hacks chopped into the stem, sprayed from aircraft or tractor-drawn sprayers, or applied by other methods. Many States have publications describing the best methods for their particular areas. Methods that work under one set of conditions may not work under slightly different circumstances. The method best suited to a local condition should be prescribed by a technician. *Strict adherence to State and local regulations concerning the use of pesticides and manufacturer's instructions for application is essential for environmental and personal safety.*

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agricultural agent, State agricultural experiment station, or local forester to be sure the intended use is still registered.



E-492405

In pruning, limbs should be cut close to the trunk.



PLANNING A HARVEST CUTTING

Harvest cuttings differ from improvement cuttings in that the primary aim is to liquidate the investment in the mature trees, rather than to improve growing conditions in the stand. In uneven-aged forests, harvest and improvement cuttings may be made in a single operation.

Several different methods can be applied in making harvest cuttings. The one to use on a specific area depends on the condition of the forest, silvicultural requirements of the tree species, objectives of the owner,

and volume of timber involved. These things are all considered when the woodland management plan is made.

Timber should never be harvested without a plan. In too many cases in the past, owners have applied to foresters for assistance in managing their woodlands *after* the timber was cut. The income derived from the land in the future will depend on how well the timber is managed now as well as later. A carefully prepared plan will provide for harvests at intervals to meet the owner's requirements.

Depending on the variable conditions and the owner's intentions, one of the following types of harvest cutting, or sometimes a combination of several types, will apply to the specific ownership.

Clearcutting

This is the system that was used in cutting much of the virgin timber, when no thought was given to reproducing desirable trees on the area logged. Consequently in many places where it was applied the results were very poor. There are certain forest types and sites where clearcutting is a desirable forest practice. Even-aged forests of species intolerant to shade and producing small wind-borne seeds are often clearcut and reseeded promptly. The system, while easy to apply, requires technical consultation to decide whether to clearcut and whether special treatments will be needed to provide for adequate reproduction, aesthetic considerations and other factors.

The clearcutting may cover the entire forest, or it may be done in patches. The size of the patches usually is governed by the size of area which will be seeded naturally by seeds from the uncut surrounding timber. The patches may vary in size from $\frac{1}{2}$ acre to 50 acres.

The owner must be reconciled to the fact that a clearcut area is not a thing of beauty, at least for several years following the cutting, and that he will not be able to cut timber from this area for many years. This is not always undesirable, especially if the ownership consists of several hundred acres, and it is cut in small patches.

Steps should be taken to assure that desirable species will get started promptly. If no natural seed is available to the area, artificial seeding or planting will be needed. If undesirable species become established on the area, they must either be eliminated to get good species established, or the owner must expect future returns considerably lower than the potential of the site.

Too frequently areas that should be clearcut are only partially cut—the operator taking only the trees he wants, leaving the poorer species and less valuable trees to grow. All trees within the clearcut area should be removed.

Seed-Tree Cutting

This system is quite similar to clearcutting except that it leaves sufficient seed trees, well distributed, to cast seed over the area. The number of seed trees required per acre varies with the species, topography, size of trees, and their ability to produce seeds. Seed-tree cutting is applicable to the same kind of stands as the clearcutting system, except that it can be used in forest types where the tree seeds are somewhat larger for they need not be carried as far by the wind. The trees of course must be windfirm, otherwise they would blow down. Seed trees should generally be the best representatives of the stand,



The trees in this forest were clearcut in patches.

F-482058

well formed, vigorous, disease free, and with indications of reliable seed-producing performance.

Where this system is used, the seed trees should be marked with a band of paint completely around the trunk, so the loggers can see the marked trees from all directions.

Shelterwood Cutting

Shelterwood cutting differs from the seed-tree system in the number of trees left after cutting. The seed-tree system leaves comparatively few trees while the shelterwood system leaves many more, not only to produce seeds, but also to protect the site while the young trees are becoming established. The residual stand is later removed in one or more cutting operations.

In this system, trees to be cut should be marked prior to each operation. This system has these advantages: It can be used with heavy seeded trees such as the oaks, the financial returns are spread over a period of years, and the forest maintains its esthetic values. It cannot, however, be used with species that demand a great deal of direct sunlight in the seedling stage.

Diameter Limit Cutting

In this system the cut is regulated by a minimum diameter limit, usually measured at stump height. This method is easy to supervise and apply, but its serious fault is that the diameter of a tree alone is not a good indication of whether it should be cut. Weak, deformed, diseased, slow-growing trees below the designated diameter may be left, while many healthy trees may be cut just when they



F-478730

Six to eight good seed-producing trees per acre were left well distributed throughout this stand.

are producing the most income. This type of cutting often results in the removal of the desirable, fast-growing, intolerant species, and perpetuates a forest of slow-growing, less desirable species, more tolerant of shade. On rare occasions, however, a diameter limit cut will serve the desired purpose, as in a stand composed of two distinct age classes, the older one of trees left from previous logging and the younger one of seedlings or saplings too small for commercial cutting.

Selection Cutting

This system is used in managing uneven-aged stands of timber. The objective is to assure a continuous replacement of desirable species as individual mature trees or small groups of them are harvested.

There are many variations of the selection system. Selection of trees to be harvested may be made by groups in managing intolerant



F-386729

Shelterwood cutting in eastern white pine in Minnesota.

species. Individual trees may be selected for harvesting in the management of more tolerant species. This system permits combining harvest cuts with commercial improvement cuts, and requires a high degree of technical skill and judgment. A tree of certain characteristics might be removed from one stand; depending on the type and condition of trees adjoining it, a similar tree in another stand should be left until the next cut. An experienced forester is the best qualified man to mark trees for removal, because no simple guide can be written to help the inexperienced woodland manager.

The results of this system of management are most favorable to the small forest owner who desires frequent and continual income from his woodland, and at the same time wants to maintain the esthetic and wildlife values.

The advantage of selection cutting is that each tree can be harvested at its highest value. Clean, straight, sound, thrifty, young, vigorous, full-crowned, well-located trees of desirable kinds can be left to produce future timber crops.



F-449903

This is a selection cutting in a mixed hardwood-coniferous woodland in New York.

PROTECTING THE FOREST



If the owner of the family forest is to gain the most from his investment he must protect it against damage. Fires, insects, diseases, storms, and grazing are some of the enemies of the forest.

The owner may not be able to give his woodland complete protection, for some of the destructive agents are beyond his control. Deer and other game cause severe but often unnoticed damage to young forests. Damage caused by wind, sleet storms, or wet snow cannot be totally prevented. But the owner can minimize the damage attributed to many causes of loss. Insects, diseases, and fires annually kill some 13 billion board feet of timber, an amount equal to a fourth of the net growth. Many trees not actually killed by these destructive agents may be retarded in growth for several years. Although fire is the most spectacular destructive agent of the forests, it ranks behind both insects and diseases in total annual growth loss and mortality. Since 1911 there has been a steady increase in the organized attack aimed at the prevention and the control of forest fires. A similarly effective attack needs to be raised against forest pests.

Fire

Each year uncontrolled fires cost the owners of small forests millions of dollars, yet the cash value of the wood destroyed is only a part of the damage. Burning kills some of the trees and weakens and slows down the growth of others. Bark beetles and diseases enter easily through the burned places. Young trees needed to establish another forest are killed. Fire destroys the fertile, moisture-holding litter on the forest floor, thereby robbing trees of nourishment and exposing the surface to erosion. Fire injuries often lower the sale value of timber products by one-half or two-thirds. Woods fires frequently destroy buildings, fences, and other improvements: and sometimes they take human life.

Cooperation for protection.—In fifty States the State Forester maintains a fire protection system. Private forest owners pay part of the costs of organized fire districts in some States. Forest owners should take the initiative in protecting their woodlands but they will find State and Federal organizations anxious to help. Owners should also inform their farm organizations, local agricultural planning leaders, and county agricultural agents of their fire problems.

The local fire warden will be glad to advise the family forest owner on measures he should take to protect his woodland from damage by fire.

Neighbors, of course, can help each other not only in preventing fires but also in detecting and suppressing them. By being alert, especially in dry seasons, they will catch fires when they are small and easy to extinguish.

The woodland owner should know his local State fire warden, have his telephone number posted for emergency calls, and promptly notify him when a fire is observed. Anyone who sees a fire should spread the alarm, tell the landowner, neighbors, and the warden or other local authorities.

Fire prevention.—Most forest fires are man made, either intentionally or carelessly; therefore, most of them can be prevented.

Ten percent of the farm forest fires are started by owners or their tenants. In some sections of the country the proportion is about one-half.

Many owners think that burning the woods will improve grazing, kill destructive insects, drive out snakes and other vermin, or improve hunting. Except under special circumstances, the harmful effects of deliberate and repeated burning of the forest usually far outweigh any small benefits. Carefully controlled burning may be prescribed for the reduction of fire hazard in some areas in the South, control of brown-spot needle blight, and site preparation for planting and seeding. Burning should not be prescribed except upon the recommendation of a forester.

Cleaning up danger spots.—Each forest owner can, himself, do much to prevent fire. Slash and debris should be pulled away from standing trees. When desirable, as it sometimes is in the West, slash resulting from logging or windthrow should be burned, but only during damp weather and in accordance with State fire laws. The tops and other useless parts of other recently killed timber should be safely disposed of. Weeds, grass, and brush along the edges of fields should be cut to reduce hazard. Cigarettes tossed by passing motorists or sparks from locomotives may start fires along roads or railway tracks if flammable material is not removed. During long dry spells it may be necessary to prohibit hunting and other uses which might add to fire risk.

Firebreaks.—Permanent firebreaks are sometimes constructed for the purpose of preventing the spread of fire from one ownership to another, or to prevent spread and facilitate control of fires within individual ownerships. The management plan may specify that large areas be divided into 20- or 30-acre blocks separated by firebreaks. These are usually made by plowing or disking to expose mineral soil and eliminate flammable material from a strip 4 to 8 feet wide. Under severe burning conditions, such as caused by a high wind, a fire may be expected to jump the firebreak. A break located well ahead of the fire edge provides a safe boundary from which to start a backfire. Firebreaks periodically should be maintained to keep them free of burnable material during critical periods.

Putting the fire out.—Fire fighting techniques vary greatly, depending upon the severity of burning conditions, topography, and other factors. Practices that are suitable under one set of conditions may be entirely unsatisfactory under others. Large fires require specialized equipment and personnel. Recommendations given here concern only small fires.



F-275041

Don't let this happen on your land. Many fires in small woodlands enter from fields or roadsides.

Generally the small fire should be checked first at its head, the place where it is burning fastest. This can be done by beating it out, making a firebreak in front of it, or wetting down the burning material with water. After the head is under control beat out the fire or make a fireline along the sides and rear. Take advantage of any trails, roads, or firebreaks that will help to stop it. Be sure the fire is out before leaving it.

Tools and equipment.—Anyone who may have to suppress a forest fire should keep adequate tools for this purpose in a place where they



F-486024

This plantation is protected by a well-maintained firebreak.

are always immediately available. Useful implements are a hoe or rake to clean firebreaks, an ax for chopping down burning snags, a shovel to throw dirt on the fire, and a water bucket for wetting down smouldering embers. In the South many farmers make their own fire swatters for grass fires by fastening a 10- by 18-inch piece of old belting to a hoe handle. Some use a large burlap bag or a pine top for fighting fires in grass and other light fuels. Sometimes the State forest fire organizations will be able to place a small supply of tools at a location convenient to several owners. In some areas local fire control organizations provide fireline plowing equipment for a nominal fee or without cost.

Pests

One of the greatest deterrents to present and future productivity of forest land in the United States is the damage caused by insects and diseases. These pests affect growth in many ways. They kill trees. They weaken tree vitality and retard growth. They deform and stunt trees. They destroy seed and seedlings. The results may be understocking, poor timber quality, encroachment of inferior tree species, and even site deterioration.

Losses from forest pests are today several times greater than those caused by forest fires. The seriousness of insects and diseases is just becoming fully understood, with control of them about where fire control was 25 years ago. Now that the magnitude of the pest problem

has been recognized, reduction in losses on a scale similar to those achieved for fire can be expected in the years ahead.

The forestry agencies of most States are organized to work cooperatively with property owners in pest control. The woodland owner should therefore be alert in spotting pest trouble and promptly report to a local official any suspicious conditions observed. If a serious pest outbreak should be developing, the owner may be eligible for State assistance in suppressing it.

Marked reductions in pest losses can come through the application of good forestry practices; for a thrifty, vigorous, growing forest that is well managed is less likely to be damaged by pests than is the unmanaged stand.

But thrifty trees are not immune to pest attack. For example, blister rust threatens young white pines much more than it does mature trees and is most serious on the thrifty ones. Certain sawflies, tip moths, and twig weevils are more prevalent and destructive in young stands than in old ones. Then too, biological conditions are unnatural in many respects where stands are established by planting. These conditions may actually increase the hazard of pest outbreaks. Other management practices that result in killing unwanted trees must be prescribed with pest activities in mind to avoid subsequent pest damage.

A road system adequate for management and fire protection will facilitate pest control operations, lower costs, and simplify the job of detecting outbreaks in their early stages. Economic conditions permitting, salvage of unhealthy trees and close utilization will help prevent centers of infection or infestation from developing and permit general pest sanitation, which will reduce losses.

Prompt action in reporting infestations and infections to public forestry officials may prevent widespread damage. Forest pest pamphlets describing in detail the principal insects and diseases troublesome in the community may be obtained from local public officials, but a few diseases and insects are described here to help the owner recognize and understand the damage they cause.

Diseases

There are many diseases that either kill trees, slow their growth, or destroy the wood fibers and so make the trees valueless for commercial purposes. The diseases can be classified into groups based on their habits or how they affect trees.

Heart rot.—Heart rots are the greatest single cause of disease losses in forest stands. These rots are caused by fungi, many of which form conks or fruiting bodies on infected trees.

The growth of heart rot cannot be stopped once it has infected a tree. The only control measure is prevention. The fungus enters a tree at a wound. A top broken off by wind or ice, large limbs broken off, fire scars, logging damage, lightning wounds, or any other wound exposing the heartwood of a tree can permit access of the fungus spore. Once established, the fungus causes increasing damage as time progresses.

Heart rot is found in all kinds of trees, but it spreads faster, and is therefore more destructive, in some species than in others.



F-237522

A conk or fruiting body on this black walnut indicates heart rot.

Cankers.—Most cankers of hardwood and softwood trees are caused by fungi. Cankers may resemble mechanical injuries at first, but they remain open and may grow larger while ordinary wounds heal. Hardwood cankers seldom kill the trees. They do deform trees, and the rot that sets in behind them often causes the tree to break at the damaged spot. Severely cankered trees should be removed whenever possible.

Rusts.—Most of the important pine cankers are caused by fungi called rusts. Rusts usually produce orange blisters especially noticeable in spring. They often spend part of their lives on one kind of plant and part on another, a fact that helps in controlling some of the worst of them.

White pine blister rust attacks any of the five-needled pines and has now spread through much of their range. This rust fungus spends part of its life on pine and part on the leaves of currant or gooseberry bushes. Rust spores formed on these alternate hosts spread to and infect pine in the summer and fall. Blisters develop on the pine in

spring, about 3 years later. Unless infected limbs are removed in time, branch blisters will spread to the trunk and kill the young tree by girdling it. Merchantable trees which become infected can usually be harvested before they die. The usual method of control for rusts is



F-433654

The canker on this tree indicates a serious disease.

to kill or remove the alternate host (currants or gooseberries) from the woodland and from a safety strip around it.

Southern pine fusiform rust attacks chiefly loblolly and slash pines. Its alternate hosts are the oaks, especially the pointed-leaf or black oak



F-501914

The white pine blister rust infecting this tree is easily recognized by the fruiting bodies.

group. The oaks are not damaged much by the rust. On pine the cankers are swollen, spindle-shaped areas on small trunks and branches, or large sunken spots on bigger trees. In early spring they form very noticeable orange blisters. Pines 1 to 10 years old are more likely than older ones to be killed by cankers girdling the trunk.

Where infections are serious, landowners should plant or seed the more rust-resistant species. Even in a heavily infected stand many trees can be saved if the cankered branches are pruned before the rust reaches the trunk. The critical time for this is when the trees are 3 to 5 years old.

The round rust galls on Virginia and shortleaf pines are caused by a similar but much less damaging rust.

The western gall rust can infect directly from pine to pine. It attacks a number of pine species in the West, particularly Jeffrey, ponderosa, lodgepole, and Digger pines. It is most harmful on seedlings and saplings, killing some, stunting and deforming many more. Unlike other rust diseases that can be controlled by the removal of alternate hosts, this disease requires the removal of infected pine trees, especially those with galls on the main stem.

Root rots.—Many root rots cause loss of timber growth, result in windthrow of some trees, and kill others outright. Particularly serious is the *Fomes* root rot of conifer plantations of the East. Since the infected part of the tree is not exposed, the disease is usually not discovered until it has been well established and the tree is seriously damaged, dying, or blown over.

Dwarf mistletoe.—Dwarf mistletoe is found on nearly all western conifer species. It is a parasite which reproduces by seeds that are too heavy to spread far. Therefore the disease is usually transmitted from larger trees to reproduction under or immediately adjacent to the infected tree. Control measures at the time of logging combined with pruning of infected parts of limbs can control the disease on small areas.

Brown spot.—Brown spot of pine needles attacks all southern pines, killing many and preventing others from growing. Small, light gray-green spots first appear on the needles. The spots change rapidly to brown, encircle the needle, and kill the part above. Severe attacks may almost strip the tree each year. The disease is worst in moist seasons and in areas of heavy grass; it is usually associated with longleaf pine types. Since longleaf pine is a very fire-resistant species, prescribed burning (fire under complete control during favorable weather conditions and at the proper season) has been found effective in controlling brown spot on this species. Spot-free seedlings put on new vigorous growth the next season. As soon as the tree reaches a height of 2 to 4 feet the danger from brown spot diminishes.

Insects

Insects attack both thrifty and unthrifty trees. Those weakened by fire, grazing, drought, logging damage, overcrowding, or disease are particularly vulnerable. The weakened trees serve as breeding grounds for insects which then spread to healthy ones, sometimes killing all trees on vast areas.



F-465063

Recovery of longleaf pine seedlings from brown-spot infections 5 months after treatment by controlled burning.

Bark beetles are among the most destructive of the forest insects. Their control is expensive and difficult. Keeping the stand healthy and growing vigorously, preventing accumulations of slash at certain seasons of the year, and observing generally good forestry practices will help to prevent bark beetle damage. Of course, the neighbors must do likewise, for insects do not respect property boundary lines in their search for food and lodging.

Symptoms of bark beetles vary by species. The presence of sawdustlike deposits on the bark or at the base of trees, pitch tubes or gum holes in the bark, or galleries on the inner side of the bark are all evidences that bark beetles have infested the tree. A forester should be summoned promptly to advise the owner of needed control measures to prevent their spread.

Leaf insects rarely kill trees by their first attack. But repeated defoliation may cause mortality. Even if death does not result, the insects can be a nuisance, especially in woodlands used for recreational pur-



F-222154

Pitch tubes on ponderosa pine bark are early signs of Black Hills pine beetle attack.

poses. If control is desirable, it may be done by application of insecticides.

Other insects cause damage by eating the buds or the cones, or by girdling small trees or twigs. The white-pine weevil is responsible for the bushy shape of many pines and other conifers in the East. A severely weeviled tree has no commercial value. This weevil can be effectively controlled by spraying the leaders or top growth of trees, either with hand equipment or helicopter.



F-482573

The wilting leaders on this eastern white pine are early evidence of attack by white-pine weevil.

Sawflies and shoot moths can cause serious and widespread damage, and loss of investments in woodlands, particularly in coniferous plantations. These pests feed on the buds and twigs, and the result is death of the ends of branches. Since their food is not entirely surface material their control by insecticides is difficult. An accurate knowledge of the life cycle of these pests is essential to effective control.

Prompt action in reporting infestations to local public officials may prevent widespread damage.

Grazing Damage

Overgrazing by livestock is always injurious to woodlands. Under certain conditions controlled grazing may do little or no damage. In some coniferous forest types of the West and South, where grass and other forage plants are a natural part of the forest environment, moderate grazing may help lessen the fire hazard, as well as provide desirable forage for stock. In the northeastern coniferous forests, light controlled grazing may help eliminate less desirable hardwoods. But in the hardwood forests of the East, even moderate grazing will prevent desirable species of trees from reproducing in the area. The most desirable species of trees for timber production also happen to be the species that are preferred by animals for forage.

The cumulative damage to the site from heavy grazing is likely to be serious and long lasting. Soil compaction and soil erosion are the end products of woodland grazing. When soil is compacted, infiltration is poor, and water runs off the surface of the land, carrying the fertile topsoil and humus with it.

Stock should be excluded from all forest types when young trees are becoming established, particularly if the area is planted. Natural reproduction often provides so many thousands of seedlings per acre that damage to some of them is not important. Plantations contain no surplus trees. Therefore they should be protected from animal damage.

Other Protection

Seedlings and saplings present in a forest at the time of cutting operations are often treated by woods workers as having no value. Yet they are very important components of the managed forest, and are needed to form the future stand. The use of proper equipment by careful operators results in very little damage to remaining timber.



F-27080

The result of protection from grazing is seen on the left. Many farm woodlands of the East have been grazed so heavily and long that the soil has been compacted, the roots are exposed at the surface and no reproduction has been established. Such woodlands are growing little, the trees are unhealthy, often have dead limbs in the crown, and are infested with insects and diseases. It will take several decades of protection to restore them to full productivity.

ROADS AND TRAILS



Getting the greatest returns from woodlands requires easy access over roads and trails, the only physical improvements usually required on small forests for the frequent harvest of timber. Quick access also is needed for protection. Location and design of the permanent roads, therefore, are of utmost importance. The cost of high-standard roads cannot be justified on the small forest, but the basic principles of proper location, grades, stream crossings, design, and drainage can be applied to low-cost forest roadways.

Skid trails or temporary roads for moving timber to main haul roads should be so located and constructed that they will cause no permanent damage to the area. After logging is completed, the roads and trails should be properly maintained or revegetated, especially if this is necessary to prevent erosion.

Preventing erosion on logging areas is very important to watershed protection. Some soils erode more readily than others, but generally the greatest risk is on the steeper slopes. Proper location and con-

struction of roads and skid trails is essential to prevent erosion in hilly country. Provision must be made for cross drainage to safely carry away excess water. If abandoned roads are eroding, corrective measures should be made to stop the damage. The local forester or soil conservationist can advise the owner on remedial measures.



MEASURING THE FOREST AND ITS PRODUCTS

Detailed instructions for measuring trees and forest products are given in a number of State bulletins. Therefore, in this publication the subject will be dealt with only in a general way.

Measuring Logs

Logs intended for lumber or veneer are commonly scaled (measured) in board-foot units. A board foot is equivalent to the volume contained in a board measuring 1 inch thick and 1 foot square. The board-foot volume of a log may be obtained by applying any one of several log rules, the choice depending on local customs. Because various log rules have different bases they give different board-foot volumes for logs of a given size. Table 1 shows the volumes given by the International log rule, $\frac{1}{4}$ -inch kerf. This log rule is based on the average diameter in inches inside the bark at the small end of the log, and the length of the log in feet. The board-foot volume is calculated by a formula which takes into consideration cutting lumber 1 inch thick, normal log taper, and losses due to shrinkage, slabs, edgings, and saw kerf.

Deductions must be made for visible defects in logs to get the net scale. There is a great deal of variation in applying different log rules, particularly in deduction for defect. If an owner plans to sell timber with payment based on log scale it is important to specify the log rule to be used and how deductions will be made for defect.

Measuring Standing Trees

The owner may want to know the number of board feet of lumber that can be sawed from a tree or the volume of pulpwood measured in cords. Tables have been prepared which give approximate volumes in these units, when the diameter at breast height (4½ feet above the ground) and the merchantable height of the tree are known. Because different tree species vary in form and thickness of bark no general table will serve. The tables give the gross volume. Deductions must be made for defect in the bole of the tree due to rot, cracks, wormholes, shake, and crook or sweep.

TABLE 1.—*Contents of logs, in board feet rounded off to the nearest ten, by the International log rule, using saw cutting $\frac{1}{4}$ -inch kerf*

| Diameter of log small end, inside bark (inches) | Volume when length of log in feet is— | | | | | | |
|---|---------------------------------------|---------|---------|---------|---------|---------|---------|
| | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. |
| 6 | 10 | 10 | 20 | 20 | 20 | 20 | 30 |
| 7 | 10 | 20 | 20 | 30 | 30 | 30 | 40 |
| 8 | 20 | 20 | 30 | 30 | 40 | 50 | 50 |
| 9 | 20 | 30 | 40 | 40 | 50 | 60 | 70 |
| 10 | 30 | 40 | 50 | 60 | 60 | 80 | 90 |
| 11 | 40 | 50 | 60 | 70 | 80 | 90 | 110 |
| 12 | 40 | 60 | 70 | 80 | 100 | 110 | 130 |
| 13 | 50 | 70 | 80 | 100 | 120 | 130 | 150 |
| 14 | 60 | 80 | 100 | 120 | 140 | 160 | 180 |
| 15 | 70 | 90 | 110 | 140 | 160 | 180 | 200 |
| 16 | 80 | 110 | 130 | 160 | 180 | 210 | 230 |
| 17 | 100 | 120 | 150 | 180 | 210 | 240 | 270 |
| 18 | 110 | 140 | 170 | 200 | 230 | 270 | 300 |
| 19 | 120 | 160 | 190 | 220 | 260 | 300 | 330 |
| 20 | 140 | 170 | 210 | 250 | 290 | 330 | 370 |
| 21 | 150 | 190 | 230 | 280 | 320 | 370 | 410 |
| 22 | 170 | 210 | 260 | 310 | 350 | 400 | 450 |
| 23 | 190 | 240 | 280 | 340 | 390 | 440 | 500 |
| 24 | 200 | 260 | 310 | 370 | 420 | 480 | 540 |
| 25 | 220 | 280 | 340 | 400 | 460 | 530 | 590 |
| 26 | 240 | 300 | 370 | 430 | 500 | 570 | 640 |
| 27 | 260 | 330 | 400 | 470 | 540 | 620 | 690 |
| 28 | 280 | 360 | 430 | 510 | 580 | 660 | 740 |
| 29 | 300 | 380 | 460 | 550 | 630 | 710 | 800 |
| 30 | 330 | 410 | 500 | 590 | 670 | 770 | 860 |
| 31 | 350 | 440 | 530 | 630 | 720 | 820 | 920 |
| 32 | 370 | 470 | 570 | 670 | 770 | 870 | 980 |
| 33 | 400 | 500 | 610 | 710 | 820 | 930 | 1,040 |
| 34 | 420 | 530 | 640 | 760 | 870 | 990 | 1,110 |
| 35 | 450 | 570 | 680 | 810 | 930 | 1,050 | 1,180 |
| 36 | 480 | 600 | 730 | 850 | 980 | 1,110 | 1,240 |
| 37 | 500 | 640 | 770 | 900 | 1,040 | 1,180 | 1,320 |
| 38 | 530 | 670 | 810 | 950 | 1,100 | 1,240 | 1,390 |
| 39 | 560 | 710 | 860 | 1,010 | 1,160 | 1,310 | 1,460 |
| 40 | 590 | 750 | 900 | 1,060 | 1,220 | 1,380 | 1,540 |

Table 2 is an example of a tree volume table in board feet, based on the International $\frac{1}{4}$ -inch rule. The owner who wants to estimate accurately the volume of his standing trees should obtain from the local forester a volume table prepared for species in his locality.

Volume tables are available for specialty products such as fence posts of a given size or mine props. Tables are also available for cubic-foot contents of trees, although this is commonly used only in research work or for special products.

Table 3 indicates the volume of standing trees in cords, based on diameter at breast height and usable height.

TABLE 2.—*Volume of sawtimber in trees, by diameter and merchantable height, International $\frac{1}{4}$ -inch rule*

| Measurement of tree at breast height (inches) | | Volume when number of usable 16-foot logs is— | | | | | | | | |
|---|---------------|---|----------------|---------|----------------|---------|----------------|---------|---------|---------|
| | | 1 | $1\frac{1}{2}$ | 2 | $2\frac{1}{2}$ | 3 | $3\frac{1}{2}$ | 4 | 5 | 6 |
| Diameter | Circumference | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. | Bd. ft. |
| 10 | 31 | 39 | 51 | 63 | 72 | 80 | | | | |
| 11 | 35 | 49 | 64 | 80 | 92 | 104 | 136 | 146 | | |
| 12 | 38 | 59 | 78 | 98 | 112 | 127 | | | | |
| 13 | 41 | 71 | 96 | 120 | 138 | 156 | 168 | 181 | | |
| 14 | 44 | 83 | 112 | 141 | 164 | 186 | 201 | 216 | | |
| 15 | 47 | 98 | 132 | 166 | 194 | 221 | 240 | 260 | | |
| 16 | 50 | 112 | 151 | 190 | 223 | 256 | 280 | 305 | | |
| 17 | 53 | 128 | 174 | 219 | 258 | 296 | 325 | 354 | | |
| 18 | 57 | 144 | 196 | 248 | 292 | 336 | 369 | 402 | | |
| 19 | 60 | 162 | 222 | 281 | 332 | 382 | 420 | 457 | | |
| 20 | 63 | 181 | 248 | 314 | 370 | 427 | 470 | 512 | 580 | |
| 21 | 66 | 201 | 276 | 350 | 414 | 478 | 526 | 575 | 656 | |
| 22 | 69 | 221 | 304 | 387 | 458 | 528 | 583 | 638 | 732 | |
| 23 | 72 | 244 | 336 | 428 | 507 | 586 | 646 | 706 | 816 | |
| 24 | 75 | 266 | 368 | 469 | 556 | 644 | 708 | 773 | 899 | |
| 25 | 79 | 290 | 402 | 514 | 610 | 706 | 779 | 852 | 992 | |
| 26 | 82 | 315 | 436 | 558 | 662 | 767 | 849 | 931 | 1,086 | |
| 27 | 85 | 341 | 474 | 606 | 721 | 836 | 925 | 1,014 | 1,185 | |
| 28 | 88 | 367 | 510 | 654 | 779 | 904 | 1,000 | 1,096 | 1,284 | 1,453 |
| 29 | 91 | 396 | 551 | 706 | 842 | 977 | 1,080 | 1,184 | 1,394 | 1,588 |
| 30 | 94 | 424 | 591 | 758 | 904 | 1,050 | 1,161 | 1,272 | 1,503 | 1,723 |
| 31 | 97 | 454 | 634 | 814 | 973 | 1,132 | 1,254 | 1,376 | 1,618 | 1,862 |
| 32 | 101 | 485 | 678 | 870 | 1,042 | 1,213 | 1,346 | 1,480 | 1,733 | 2,001 |
| 33 | 104 | 518 | 724 | 930 | 1,114 | 1,298 | 1,442 | 1,586 | 1,858 | 2,152 |
| 34 | 107 | 550 | 770 | 989 | 1,186 | 1,383 | 1,537 | 1,691 | 1,984 | 2,304 |
| 35 | 110 | 585 | 820 | 1,055 | 1,266 | 1,477 | 1,642 | 1,806 | 2,124 | 2,458 |
| 36 | 113 | 620 | 870 | 1,121 | 1,346 | 1,571 | 1,746 | 1,922 | 2,264 | 2,612 |
| 37 | 116 | 656 | 922 | 1,188 | 1,430 | 1,672 | 1,858 | 2,044 | 2,416 | 2,783 |
| 38 | 119 | 693 | 974 | 1,256 | 1,514 | 1,772 | 1,970 | 2,167 | 2,568 | 2,954 |
| 39 | 123 | 732 | 1,031 | 1,330 | 1,602 | 1,874 | 2,087 | 2,300 | 2,714 | 3,127 |
| 40 | 126 | 770 | 1,086 | 1,403 | 1,690 | 1,977 | 2,204 | 2,432 | 2,860 | 3,300 |

Data from Mesavage and Girard, Tables for Estimating Board-Foot Volume of Timber. (Form class 80.) U.S. Department of Agriculture, Forest Service. 1946.

For exceptionally tall, slender trees add 10 percent.

For exceptionally short, stubby trees deduct 10 percent.

Measuring Cordwood

The cord is the cubic unit used to measure various stacked wood products such as fuelwood, pulpwood, excelsior wood, and chemical wood. This group of products is commonly referred to as cordwood when so measured. A standard cord is 4 by 4 by 8 feet. Pulpwood is bought in units of various lengths of sticks, 48, 54, 60, and up to 100 inches long. If the sticks are 54 inches long the unit is referred to as a "144 cu. ft. unit." If the wood is excessively crooked or is not compactly piled, deductions are usually made in the gross measurement.

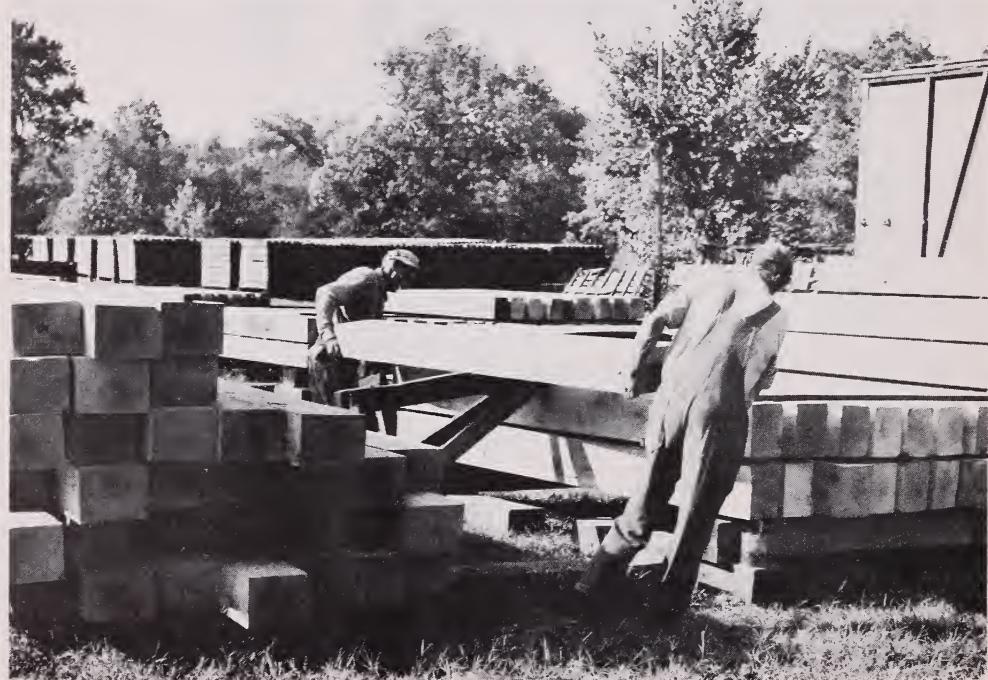
Piece Measure

Many products such as posts, poles, piling, crossties, and mine timbers are marketed by number of pieces of certain sizes and grades. Specifications and an order or contract should be obtained from the buyer before cutting these products.

TABLE 3.—*Volume in cords¹ (128 cubic feet including bark) by diameter and usable height*

| Measurement of tree at breast height (inches) | | Volume when usable height in feet is— | | | | | | | |
|---|---------------|---------------------------------------|-----------------------|-----------------------|--------------|--------------|--------------|--------------|--------------|
| Diameter | Circumference | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 |
| 4 | 13 | <i>Cords</i> 0.007 | <i>Cords</i> 0.011 | <i>Cords</i> 0.022 | | | | | |
| 5 | 16 | .011 | .019 | 0.022 | | | | | |
| 6 | 19 | .017 | .028 | .040 | 0.047 | | | | |
| 7 | 22 | .023 | .038 | .053 | .068 | 0.076 | | | |
| 8 | 25 | .031 | .050 | .068 | .087 | .106 | 0.116 | | |
| 9 | 28 | .040 | .065 | .088 | .109 | .130 | .153 | 0.170 | |
| 10 | 31 | .049 | .082 | .111 | .133 | .160 | .188 | .211 | |
| 11 | 35 | .060 | .100 | .137 | .165 | .190 | .221 | .250 | 0.270 |
| 12 | 38 | .070 | .121 | .165 | .198 | .225 | .260 | .300 | .330 |
| 13 | 41 | .082 | .143 | .197 | .236 | .268 | .305 | .350 | .42 |
| 14 | 44 | .095 | .167 | .228 | .273 | .311 | .353 | .40 | .47 |
| 15 | 47 | .107 | .193 | .262 | .318 | .364 | .41 | .46 | .52 |
| 16 | 50 | .122 | .220 | .300 | .367 | .42 | .47 | .53 | .59 |
| 17 | 53 | .138 | .250 | .340 | .42 | .48 | .54 | .59 | .66 |
| 18 | 57 | .155 | .282 | .382 | .47 | .55 | .60 | .65 | .73 |
| 19 | 60 | .173 | .318 | .43 | .53 | .61 | .68 | .73 | .81 |
| 20 | 63 | .194 | .353 | .48 | .59 | .68 | .76 | .81 | .89 |
| 21 | 66 | .217 | .395 | .54 | .66 | .76 | .84 | .90 | .98 |
| 22 | 69 | .240 | .44 | .60 | .73 | .84 | .93 | 1.00 | 1.07 |
| 23 | 72 | .262 | .48 | .66 | .80 | .92 | 1.03 | 1.10 | 1.17 |
| 24 | 75 | .288 | .52 | .72 | .88 | 1.00 | 1.12 | 1.21 | 1.28 |
| 25 | 79 | .312 | .58 | .78 | .96 | 1.10 | 1.23 | 1.33 | 1.38 |
| 26 | 82 | .340 | .62 | .84 | 1.04 | 1.19 | 1.33 | 1.44 | 1.51 |
| 27 | 85 | .363 | .67 | .91 | 1.13 | 1.29 | 1.45 | 1.56 | 1.63 |
| 28 | 88 | .388 | .72 | .97 | 1.20 | 1.38 | 1.55 | 1.67 | 1.76 |
| 29 | 91 | .41 | .76 | 1.03 | 1.29 | 1.49 | 1.66 | 1.80 | 1.90 |
| 30 | 94 | .43 | .80 | 1.10 | 1.37 | 1.59 | 1.7 | 1.93 | 2.04 |

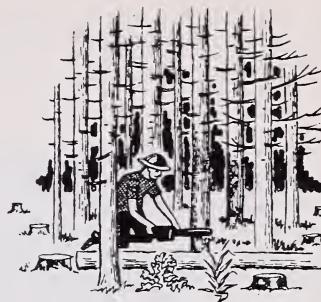
¹ The bold figures in the upper part of the table are to a minimum top diameter (inside bark) of 3.0 or more but less than 4.0 inches. Other top diameters are variable but not less than 4.0 inches.



F-488261

Crossties are an important timber crop in general demand.

HARVESTING THE TIMBER CROP



The woodland owner can sell his standing trees, called "stumpage," or he can harvest them himself and sell the logs and other products.

If he chooses the latter course his return will include not only the value of the stumpage but also income from the use of his own labor, equipment, and managerial service. He can do the work himself or have it done under contract by an experienced operator.

The owner who does his own harvesting or contracts to have it done can profit by converting his timber to those products that will bring him the most profit. For example, poles or piling can be separated from saw-log trees, veneer quality logs can be separated from saw logs, and pulpwood can be cut from material not suitable for saw logs.

Owners who plan to sell timber products should always locate a market and have a sale agreement before they fell any trees, because cut trees are perishable.

The markets for some types of forest products fluctuate considerably and the prices paid are usually influenced by the demand for the product. The family forest owner who is not completely dependent on returns from his timber is in a favorable position to negotiate with timber buyers and take advantage of a good market. He is not forced to sell stumpage when prices are down. Although the management plan may call for cutting in a given year, unlike most agricultural crops, timber crops do not deteriorate at the end of the season. The timber will continue to grow, and the owner can wait for prices to return to a favorable level before selling.

If he does his own logging, he will probably exercise maximum care to avoid damage to young trees, to prevent fire, and in general to make the best use of his woods. Furthermore, with a few exceptions, the work can be done whenever there is time for it. It may even be a welcome change from regular tasks.

How much work the owner can do will depend upon the time and equipment available and the products to be marketed. Frequently, little equipment other than that already on the farm is required to cut logs, poles, and pulpwood and place them at the roadside. From this point on, special equipment such as a loader and log truck may be desirable although these are not always essential. Careful analysis is necessary to determine the economic feasibility of investing in expensive equipment for operating a family forest holding. Ordinarily the owner of a family forest should keep out of the sawmill business unless he is well informed about it.

In many localities it is possible to contract some or all of the jobs connected with harvesting timber crops. The owner, for example,

can sell saw logs delivered to the sawmill, but not do any of the work himself. He needs no equipment or skill; instead, he contracts to skilled operators the cutting, skidding, and hauling.



F-443516

Farm machinery can be used during the off season to harvest the timber crop.

PRODUCTS OF THE FOREST



Veneer Logs

High-grade veneer logs are one of the highest valued primary forest products. There are many kinds of veneer, and corresponding types of veneer logs. The Douglas-fir veneer used for construction purposes, hardwood furniture veneer, and basket and box veneer are a few of the more common, each of which requires a special type of log.

Most veneer is rotary cut (peeled off the bolt in thin sheets) so the condition of a small part of the center of the log is not always im-

portant to the product. All other parts of veneer logs should be free of knots and other defects. Some high-quality hardwood veneer is sliced or sawed to provide special grain effects.

Saw Logs

The demand for saw logs is greater than the demand for any other timber product. There are several grades, usually based on the quality of the lumber or timbers they will produce. Structural lumber requires strength, therefore defects affecting strength of the timber are important in determining the grade. Mill lumber is graded on the presence of defects affecting appearance, such as rot, knots, cracks, and wormholes. Very low grades of lumber may have local uses or may be sold for dunnage. Usually no saw log is accepted under 8 feet in length. The minimum diameter varies from 8 to 12 inches at the small end of the log, but some mills will accept even smaller logs. A few inches is always included in the log length to allow for trimming the lumber. Be sure to follow the local practice for trim allowance or that specified by the purchaser.

Poles and Piling

Poles for electric power transmission lines, telephone communications systems, and certain types of buildings are in constant demand, as is piling used to support other structures. A tree of suitable size and form to make one of these products will usually bring more money per unit of board-foot volume than will the same tree cut into saw logs or shorter products. Trees of high quality are required for this purpose.

Southern pines treated against decay, together with eastern white-cedar, furnish most of the southern and eastern pole timber. Western redcedar, western larch, Douglas-fir, and lodgepole pine are used extensively in the Northern Great Plains and the West. Douglas-fir, western larch, southern yellow pines, and oak are used where great strength is needed.

Poles and piling must be butt cut, cut square at both ends, fairly straight, and well-proportioned from top to butt, and peeled knots must be trimmed close. Defects are crook, split tops and butts, rot, checks, shakes, and wormholes.

Poles and piling specifications vary so much that before cutting the owner should know exactly what sizes the buyer will take.

Pulpwood

Pulpwood is used for making paper, rayon or other chemical products, pulpboard, wallboards, and roofing. Requirements vary widely with the different mills. The forest owner who wishes to cut pulpwood should get specifications from his local forester or from the buyer.

Some owners sell stumpage directly to company agents or to contractors. Others sell pulpwood loaded on the railroad car. In this case it is measured as stacked on the car, usually after delivery to

the plant. For the owner who sells delivered to the railroad siding, the wood is either measured on the truck before unloading or when piled on the ground. Although pulpwood is usually measured as described on page 45, some pulpmills purchase wood by weight.

Other Products

There are numerous other timber products that are important in many localities. Railroad ties are produced from many species of wood, either as center cuts from large logs after the high-grade, side-cut boards have been sawed, or as the only product from smaller logs. Several grades and sizes of ties are used from the long switch ties on mainline railroads to the small ties in mines for narrow-gauge equipment. They are usually sold by the piece and by grade.

Mines use many kinds and forms of timber besides lumber and ties. Props, lagging, and bars may be round timbers, while caps and sills are hewed or sawed. The sizes vary greatly, so the producer must check specifications carefully. This is an excellent market for small-sized trees, which often should be removed in thinnings and improvement cuttings.

Bolts are short sections of a tree, less than 8 feet long, used for cooperage, excelsior, woodenware, handles, and so on. Tight cooperage staves of white oak bring high prices, but they require high-quality wood. Each market has rigid specifications and the producer must know them. Bolts may be sold by the cord, board foot, or some other unit.

Fuelwood and charcoal wood markets exist in certain localities. They utilize low-grade wood of all species, cut to various lengths from 1 to 4 feet. Fuelwood is often sold by the cord, rick, or truckload. A standard cord of dry oak, hickory, beech, maple, or longleaf pine provides about as much heat as a ton of anthracite coal or 200 gallons of fuel oil. Lighter woods produce only about half as much heat. Dry wood produces much more heat than green wood. By finding a local market for fuelwood or charcoal wood, the owner is often able to dispose of low-quality trees from his forest without out-of-pocket costs. Even if no return is realized from the stumpage the benefit to the forest is worth the effort.

Many other products of the forest may add to the financial benefit of the owners. Among these are Christmas trees and greens obtained from thinning and pruning young stands, maple sugar and syrup in the northern States, naval stores from the southern coastal pines, ferns from the Northwest, fence posts and rails, and chemical extract wood and bark for tanning extract.

CARING FOR TIMBER PRODUCTS



Once timber has been felled, it must be protected from weather, excessive and uneven drying, dampness, disease, and insects. For these and other reasons, it is very desirable to sell and deliver timber products as soon as possible after they are cut. When this is impossible, they should be stored safely. In summer, blue stain may develop in 6 or 7 days; insect and checking damage, in a few weeks. Timber cut early in winter, however, may often be held into the following spring without damage. All of these problems are more acute in the South than in the North.

As soon as a tree is felled, it begins to lose its moisture. All green timber, if it dries too slowly, is liable to be attacked by stain, rot, or insects. When the season is warm or damp, logs and other round timber should be quickly taken to a dry, well-aired, shady place and put on skids well off the ground. The most practical way to prevent stain, and other damage, is to cut trees during dry, cool weather and move them quickly to market. Logs and certain other timber products may also be stored under water. When completely submerged, they need no further care.

Lumber seasons faster than logs, posts, and poles because more wood surface is exposed to air. If it dries unevenly and too fast, however, it will check, split, crack, or warp. Sap or blue stain greatly affects the appearance, though not the strength of lumber, and may cause degrading. Logs are often badly stained before sawing, but green lumber too will stain easily.

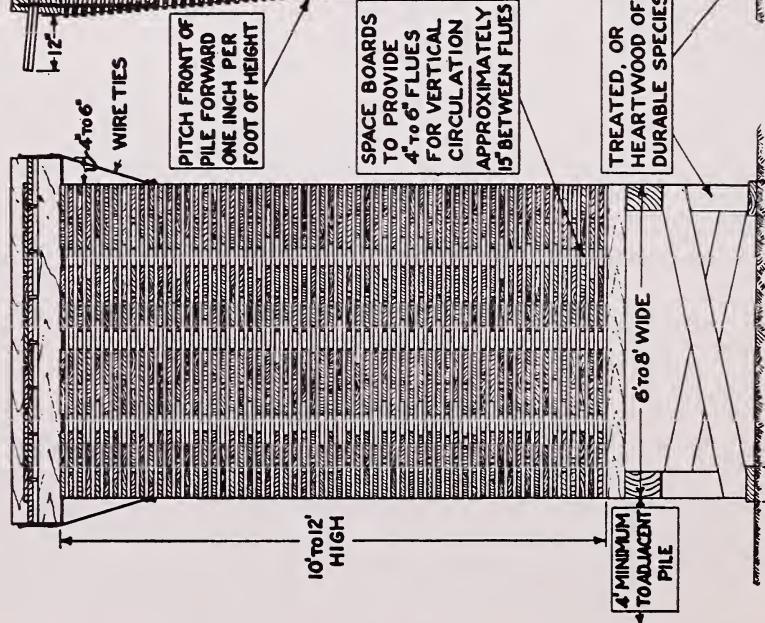
Green, fresh-sawed lumber kept for home use should be stacked for seasoning as soon as possible in some open, level, well-drained place. The stack should be well off the ground, protected from the sun and precipitation, and piled so that air can circulate freely through it. Good seasoning of lumber is very important.

Poles, piling, posts, and other products that will not be damaged by checking or seasoning cracks should be peeled immediately and seasoned rapidly.

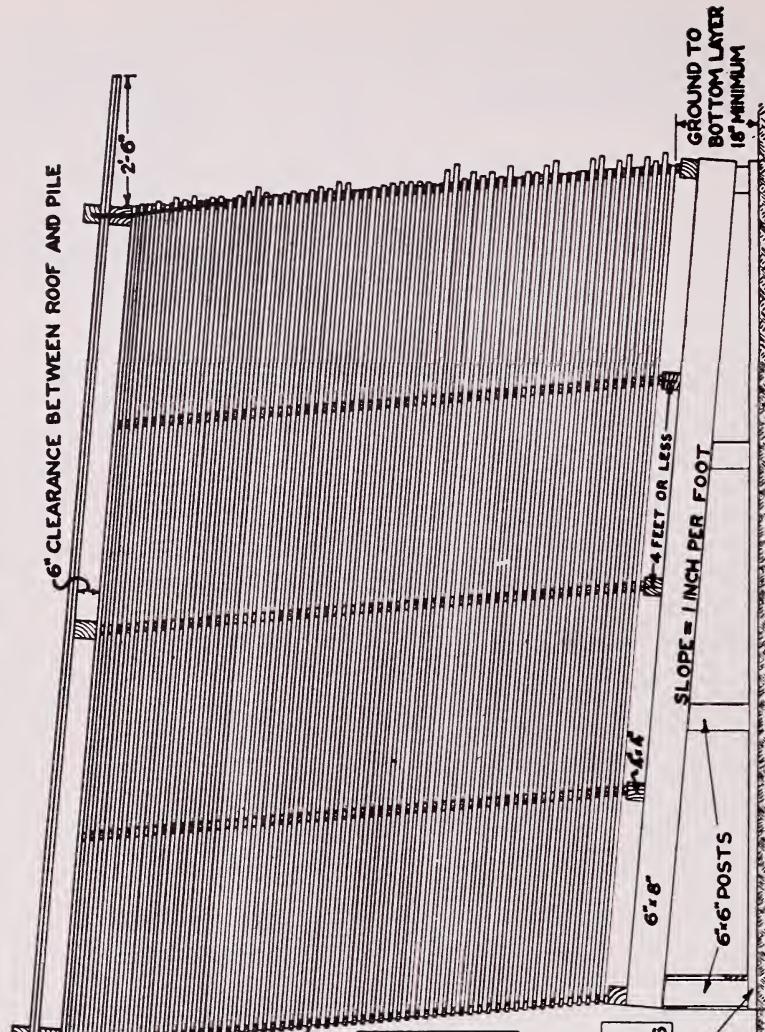
Bolts for specialty products may require special handling to prevent damage from stain, insects, and checking. The buyer's instructions concerning care of the wood should be observed.

From 25 to 55 percent of the weight of green wood is water; a cord of shagbark hickory loses 800 pounds, and gains about one-sixth in heat value, while drying. Because it burns better and gives more heat when dry, firewood should always be seasoned before being used. Three months' seasoning in reasonably dry weather gives green wood 90 percent of the heat value of thoroughly air-dried wood. Complete sea-

FRONT VIEW



SIDE VIEW



Essential features in piling lumber outdoors for rapid and uniform air seasoning.

soning takes 6 months to a year. Splitting helps, especially with large hardwoods. Live trees felled in summer dry out faster if the leaves are left on for 2 or 3 weeks. Stacks of cordwood can be dried outdoors in the sun and wind. For best results the pile should have a cover, or the top layer of sticks may be packed closely and slanted to shed rain. Use bed pieces to keep the bottom layer off the ground. Piling criss-cross speeds seasoning.



SELLING FOREST PRODUCTS

A profitable sale is the payoff in good forest management. It determines whether the owner's investments in cash and labor have yielded the highest return practicable. Selling forest products requires knowledge of products and markets, and experience.

Too many people sell their trees to the first buyer who offers a lump sum for all their timber as it stands in the woods. Sales of this kind made without knowledge of the volume, quality, and value of the timber are unwise and often unprofitable. It is of utmost importance that the timber owner know what he has to sell, both kind and amount. *A prime rule of good selling: Know how much timber you have for sale.*

Reports of woodland owners who received technical assistance from foresters prior to selling their timber demonstrate the value of knowing what you have for sale. A typical example is the case of the owner of a family forest property in Oregon who had been offered \$10,000 for his timber. Through the help of a forester, the owner received \$60,000 for it. This is not an isolated nor exaggerated example. Foresters' files are full of similar cases.

Finding a Market

Whether the forest owner sells stumpage or converted products, he usually gains by looking over all likely markets before closing a deal. His local forester will know local prices and markets and may also be able to recommend firms farther away. Very often it will pay to advertise in the local paper, or, if a large volume of timber is to be sold, in a lumber trade journal. Of course, the owner will hear about sales his neighbors have made. Also, he can ask various wood-using concerns for prices.

Selling Stumpage

When the decision has been made to sell stumpage, the owner has a choice of (1) selling for a lump sum all designated timber, or (2)

selling for a price per unit of measure, such as per thousand board feet (M bd. ft.) or per cord.

In selling for a lump sum, the selling price is best determined on the basis of tree measurement made at the time the trees are marked for cutting. The main advantages of selling on a lump sum basis are (1) there is no question about scale, (2) the operator is not held up awaiting a scale of timber by the owner, and (3) the operator usually utilizes closely by taking poorer trees and poorer parts of the trees. He does this because he pays nothing extra for this material.

In selling at a unit price the owner should measure the timber cut rather than depend on the measurement by the buyer. If the owner is not in a position to measure the cut product before it is removed from the forest, he should select the first alternative, that is, sell designated trees for a lump sum.

Some buyers of sawtimber who also operate sawmills prefer to buy on mill scale (scale of lumber after sawing). This system may not give the best returns to the woodland owner. The buyer might take only the high-quality logs and saw them for the highest grade, which would produce only a small volume of high-grade lumber. This may be to the advantage of the mill man, but not to the advantage of the seller. Where quality is an important factor in establishing stumpage value, and this is frequent, the owner may need assistance in determining a fair price.

The value of stumpage is appraised by deducting from the value of a product at a given point, the cost of processing and delivery to that point plus a fair profit for the operator. For example, the price of pulpwood is often quoted f.o.b. the mill. From that price should be deducted the cost of cutting the trees, sawing them into pulp-length bolts, and transporting the bolts from the stump to the plant. These costs must include not only labor and equipment operation costs, but also such miscellaneous items as social security payments, workman's compensation, equipment depreciation, unemployment insurance, and interest on invested capital, plus a fair profit to the operator. Whatever is left after these deductions represents the appraised value of the stumpage. Therefore consideration must be given not only to the quantity and quality of timber (which largely determines the selling price of the product) but also to the operating costs, which are influenced by accessibility, ease of logging, and distance to market.

The price actually received for stumpage, however, may be more or less than the appraised value. The actual price often depends on the bargaining powers of the seller and the buyer. The law of supply and demand plays a large part in determining the stumpage prices in small forest sales. The proper timing of sales and ability of the owner to negotiate for the best deal often will favorably influence the determination of price received.

Selling Converted Products

One of the problems of the forest owner who wishes to sell converted products will be to select the ones that will bring him the greatest returns. Saw logs and veneer logs usually bring the most money,

but sometimes part of the crop pays more if sold as other products. For instance, tall, straight, well-tapered southern yellow pines, Douglas-fir, or oaks may net more as poles or piling than as sawtimber. Large, high-grade logs of some woods like Douglas-fir, white pine, sweetgum, yellow-poplar, maple, and magnolia will often bring best prices as veneer. Good white oak sometimes sells at high prices to plants making barrels. It may pay to take the long, high-grade logs to a mill sawing large timbers; the shorter ones to a mill sawing lumber. It may be worth while to sell the hardwood and softwood



F-475750

Most trees are marked for cutting with a spot of paint about 5 feet above the ground and another below stump height. The upper spot is for easy finding by the cutters. The lower one is to indicate that the cutting of the tree was authorized.

logs separately. Before he "high-grades" or skims off his best stock, though, the forest owner should be sure that he can also sell what is left at a fair price. At the same time, if he plans a combined cutting of sawtimber and poles, he should be sure that the income from the two products will be as much or more than he would otherwise have received for one.

The timing of sales of forest products is particularly important because of the seasonal fluctuation of markets. Most plants have limited storage facilities for logs or bolts. In order to avoid loss from deterioration they keep only a limited supply on hand. In the seasons of the year when logging and transporting timber is easy and most small landowners and operators deliver their products to the plant, the buyer may be temporarily supplied with all the timber or wood he can safely stockpile. He may then cancel orders or instruct contractors to withhold delivery. The owner who has an inventory of logs or other products then must assume the risk of loss due to deterioration; meanwhile he is receiving no interest on his invested capital.

Very often the forest owner can do little about this unstable market. When dealing with a buyer who has a standard contract used with all producers he must either accept the standard contract or attempt to market his product elsewhere. One of the best ways to minimize the risk of uncertain markets is to deliver the product promptly when the contract is awarded. If at all possible, products should be delivered at the first opportunity; otherwise market conditions may change and a loose contract very likely will not require the buyer to accept timber at a specific time.

Timber Sale Contracts

A written contract should be used in the sale of all forest products, both stumpage and converted products. The contract can be prepared by the seller with the help of his attorney, or it may be prepared by the purchaser who frequently uses a standard form. Timber sale contracts need not be complicated but they should include all items agreed upon.

No standing contract for selling stumpage adequately covers all circumstances. The timber sale contract should include every item that may be subject to question during the operation. Only a person who is experienced in timber sales can possibly know what these items are. Therefore the owner should get the advice of a forester before preparing a stumpage sale contract. Too often owners seek the advice of the timber buyer, who knows what protection he expects from the agreement, but does not know what protection it should provide the forest owner. Lawyers are helpful in advising on the legal aspects of such transactions; however, not all of them are qualified by experience to prepare adequate timber sale agreements. If the owner wants his lawyer to prepare the sale agreement, he should have a forester list the important items that should be included. If the sale contract is prepared by the owner, it may be checked by a lawyer to be sure it meets the legal requirements of the State.

Owners who sell large volumes of stumpage usually require purchasers to post a bond or to guarantee compliance with the sale agree-

ment by a deposit in escrow. In many localities, where stumpage buyers are not accustomed to posting bond, the small forest owner may not be able to get one with the timber sale agreement, although it is desirable.

SAFETY IN THE FOREST



Experience has shown that many accidents occur in the forest—and a large percentage of them are fatal. The family forest owner, who probably is not accustomed to forest work, is particularly vulnerable, unless he is extremely careful and takes all possible precautions to prevent being injured.

Experienced workers wear hard hats to protect their heads from falling limbs. They wear heavy shoes, trousers without cuffs, and other practical clothing that has proved best for woods work. They know the safe way to carry sharp tools, and use them in a manner that will not result in injury to themselves or coworkers. Experienced woods workers take the necessary precautions to guard against infection by poison oak or poison ivy. They know what to do in case of snake bite. In working with logs, they are ever mindful of the possibility of logs rolling or sliding, so they always take a safe position.

Many publications on safety are available to woodland owners. Some State forestry departments have published safety handbooks; and the U.S. Department of Agriculture, Forest Service, has issued a "Health and Safety Code." When the local forester has reviewed your timber operation with you, he will be able to give valuable recommendations on safety.

SPECIAL ASSISTANCE FOR FAMILY FOREST OWNERS



Technical Aid for the Forest Owner

This bulletin frequently refers the woodland owner needing technical assistance to local foresters who may be employed by any one of the following public or private groups or agencies:

The State Extension Service, headquartered at the land grant colleges or universities, employs Extension Foresters who specialize in providing information to family forest owners and are available to establish forest management demonstrations and assist in other ways. The County Agricultural Agent is the local representative of the State Extension Service. He is a trained agricultural specialist whose field of work encompasses all phases of cropland and livestock production and management. He can assist in unifying the woodland plan with the farm enterprise. In addition, the county agent is oftentimes the informational clearing house for all farm and rural activities in a county. Through his contacts with farm groups and county committees he can encourage the consideration of forestry problems and the development of a forestry educational program. This assistance and that available through county planning groups offer means of initiating forestry projects on a countywide basis. Because of his intimate knowledge of the community he can channel the woodland owner to the proper technician for help. The county agricultural agent can be contacted at the county seat, where he usually has offices in the courthouse.

The State Forester, who is usually located at the State capital city, employs technically trained Service or Farm Foresters to provide on-the-ground assistance to family forest owners in managing their woodlands. They also provide assistance to primary wood processors. They may be contacted through the appropriate State forestry office.

In addition to providing advice of a general nature and woodland planning service, the farm foresters also can assist owners with the marketing and selling of their timber crops. This service generally is furnished the owner without cost, but in some States a nominal fee is charged for estimating and marking timber.

Industrial Foresters are sometimes available to work with woodland owners who may be prospective suppliers of wood to the firms employing them. Industrial foresters may provide free marking service and in some instances develop management plans for the woodland owners. They are employed principally by pulp and paper companies, pulpwood dealers, forestry associations, and the larger sawmill companies. The names and addresses of these individuals can usually be secured from the local county agent or farm forester.

Consulting Foresters are self-employed foresters who provide technical services for a fee. The services provided by this group cover all forestry problems and forms of assistance, limited only by the experience and training of the individual and the owner's desires. For absentee owners and those resident owners who are unable to supervise forestry operations closely, the consultant is able to act as agent to assure that contract terms for cutting or improvement work are met.

Current lists of consultants are available from the local forester or the State Forester.

Soil Conservation Districts arrange for complete farm planning services to cooperating landowners. They also arrange for technical services the landowner may need to carry out his woodland management practices. Many Districts have planting, site preparation, and timber stand improvement equipment available for rent to cooperators.

In many cases, experienced crews to do forestry work are employed by the District.

If you do not know the location of your Soil Conservation District Office, the county agent can tell you where it is.

Other Services. Contract tree planters and T.S.I. crews are available in many parts of the United States. Local agricultural agents or local foresters can advise owners how to obtain such services.

Financial Assistance for timber stand improvement and tree planting is available in many counties through the Agricultural Conservation Program. Offices are maintained in most county seats.

Sample Timber Sale Contract Form

The following timber sale contract form is intended only to give prospective stumpage sellers ideas of some of the items which should be included in timber sale contracts. It is not intended for use as a standard contract, for it will not suit the particular set of conditions that prevail on any specific sale area.

----- of -----, (I or we) (Name of purchaser) (Post Office),
 -----, hereinafter called the purchaser,
 (State) (ZIP Code)
 agree to purchase from ----- of -----, (Seller's name) (Post Office),
 -----, hereinafter called the seller, the
 (State) (ZIP Code)
 designated trees from the area described below:

I. Description of Sale Area:

(Describe by legal subdivisions, if surveyed, and approximate, if not)

II. Trees Designated for Cutting:

All ----- trees marked by the seller, or his agent
 (Species) with ----- paint spots below stump height; also dead
 (Color) trees of the same species which are merchantable for ----- (Kind of forest products)

III. Conditions of Sale:

A. The purchaser agrees to the following:

1. To pay the seller the sum of \$----- for the above-described trees and to make payments in advance of cutting in amounts of at least \$----- each.

2. To waive all claim to the above-described trees unless they are cut and removed on or before -----, which is the termination date of
 (Date) this contract.

3. To do all in his power to prevent and suppress forest fires on or threatening the sale area.

4. To protect from unnecessary injury young growth and other trees not designated for cutting.

5. To pay the seller for undesignated trees cut, or trees injured through carelessness, at the rate of \$----- each for trees under 10 inches in diameter inside the bark, measured at stump height, and \$----- per thousand board feet for trees measuring over 10 inches in diameter inside the bark at stump height.

6. To repair ditches, fences, bridges, roads, trails, or other improvements damaged beyond ordinary wear and tear.

7. Not to assign this agreement in whole or in part without the written consent of the seller.

8. To indemnify and hold harmless the seller from any and all damage, claims, or demands upon the part of third parties on account of any action by purchaser, his agents, servants, or employees, under this agreement, and furthermore to respect and protect any rights-of-way, easements, and servitudes belonging to any other party or parties, and enjoin not to injure, damage, or waste the same in any way whatsoever, and does hereby indemnify and hold harmless the seller therefrom.

B. The seller agrees to the following:

1. To guarantee title to the forest products covered by this agreement and to defend it against all claims at his expense.

2. To allow the purchaser to use unmerchantable material from tops of trees cut or from trees of _____ species for necessary logging improvement free of charge, provided such improvements are left in place by the purchaser.

3. To grant the freedom of entry and right-of-way to the purchaser and his employees on and across the area covered by this agreement and also other privileges usually extended to purchasers of stumpage which are not specifically covered, provided they do not conflict with specific provisions of this agreement.

C. In case of dispute over the terms of this agreement we agree to accept the decision of an arbitration board of three selected persons as final. Each of the contracting parties will select one person and the two selected will select a third to form this board.

Signed in duplicate, this _____ day of _____ 197_____

(Witness)

(Purchaser)

(Witness)

(Witness)

(Seller)

(Witness)

Tree Planting Contract

A tree planting contract should include the following provisions in addition to a description of area to be planted:

The owner agrees to:

1. Rate of pay—per hundred trees or per acre. Specify that payment will be made only upon satisfactory completion of contract.

2. If payment does not include cost of trees, state point of delivery of trees by owner.

3. Provide right of ingress and egress to contractor, crew, and equipment.

4. Provide sketch map showing area to be planted, indicating specific areas not to be planted that may be included in the general area of planting (such as distance from roads, line of trees, etc.).

The contractor agrees to:

1. Provide necessary tools, equipment, and labor. (If contractor is to furnish trees, specify number by species, age, and size.)

2. Dates to begin and end planting. Specify other conditions that may affect time of planting, such as dry soil, frozen ground, water puddles in planting area, etc.

3. Abide by specifications for planting with a tolerance factor of not more than 10 percent. (Get recommended or approved specifications on spacing of trees, depth of planting, care of planting stock before and during planting, etc., from local forester.)

4. Be responsible for damage to property, such as fences, ditches, etc., caused by contractor or his crew.

It is desirable but not always possible to require the contractor to post a bond equal to at least the cost of the planting stock, if the owner provided the stock, to guarantee satisfactory completion of the contract. If no bond is posted, it is desirable to include in the agreement penalties for failure to fulfill conditions of the agreement.

Reference Material

Federal and State agencies have prepared publications covering many subjects of interest to the family forest owners. Many of these bulletins pertain to a single tree species or pest, or they apply to a certain section of the country. The local public official can advise the woodland owner as to where he may obtain such publications that cover the desired subject.

The following publications covering the entire United States are only some of the many available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402:

| | Price |
|--|---------|
| Logging Farm Wood Crops (Farmers' Bulletin No. 2090)----- | \$0. 20 |
| Trees—1949 Yearbook of Agriculture----- | 2. 75 |
| To Know the Trees: Important Forest Trees of the U.S.----- | . 20 |
| Preservative Treatment of Fence Posts and Farm Timbers (Farmers' Bulletin No. 2049)----- | . 15 |
| Tables for Estimating Board-Foot Volume of Timber----- | . 45 |
| Health and Safety Code (U.S. Department of Agriculture)----- | 3. 00 |
| List of available publications of the U.S. Department of Agriculture----- | . 45 |

Shape YOUR FUTURE

Manage Your
Family Forest

Start Now !

